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Alameda Watershed Management Plan
Peninsula Watershed Management Plan

APPENDIX C
VOLUME II

San Francisco Public Utilities Commission

November 1998

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List of Appendices

The following documents and memoranda were prepared during the course of the watershed management planning process. This information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Alameda Watershed Management Plan. Some specific issues noted in the following appendices may have been refined through the planning process. These refinements are reflected in the Alameda Watershed Management Plan.

The items shaded in the List of Appendices below are bound together in this volume.

Appendices A and B are not listed below as they are specific to the Peninsula and Alameda Watershed Management Plans and their contents differ.

Appendix C. Peninsula and Alameda Watersheds: Surveys and Technical Memoranda[2]

Volume I

C-1 Watershed Sanitary Survey for the Alameda and Peninsula Watersheds, October 1995

Volume II

C-2 Technical Memorandum #1: San Francisco Water System Facilities and Practices, April 1993

C-3 Technical Memorandum #2: Water Quality Vulnerability Zone Development, March 1994

C-4 Technical Memorandum #3: Sediment Yields of Alameda and Peninsula Watersheds, September 1994

C-5 Technical Memorandum #4: Visual Resources, November 1996

C-6 Technical Memorandum #5: Best Management Practices (to be completed)

C-7 Technical Memorandum #6: Economic Profile of Watershed Land Management by the San Francisco Water Department, November 1993

C-8 Technical Memorandum #7: Demographic Profile of Areas Adjacent to Peninsula and Alameda Watershed Lands, November 1993

C-9 Technical Memorandum #8: General Plans Review, June 1994

C-10 Technical Memorandum #9: Utilities and Infrastructure Review, June 1994

C-11 Technical Memorandum #10: Regional Recreational Facility Inventory, June 1994

C-12 Technical Memorandum #11: SFPUC Policies, September 1993

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Appendix D. Peninsula and Alameda Watersheds: Planning Process and Public Participation Reports and Materials[1]

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D-2 Technical Memorandum #12: Watershed Management Planning Process, September 1996

D-3 Agency Interview Summaries, February 1994

Public, Agency and Staff Workshop Summaries

Volume II

D-4 Workshop Summary Report #1, May 1993

D-5 Agency Workshop Report 31, July 1993

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D-7 SFWD Staff Workshop Report #1, February 1994

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- Volume 8, Fall 1997 (to be completed)

D-14 Brochures
- Coordinated Water Management: An Orientation to the Water System of the City and County of San Francisco

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[1] *Material in this Appendix covers both the Peninsula and Alameda Watersheds, and therefore it is a common Appendix to both the Peninsula Watershed Management Plan and the Alameda Watershed Management Plan.*

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Appendix C-2

Technical Memorandum #1
San Francisco Water System Facilities and Practices
April 1993

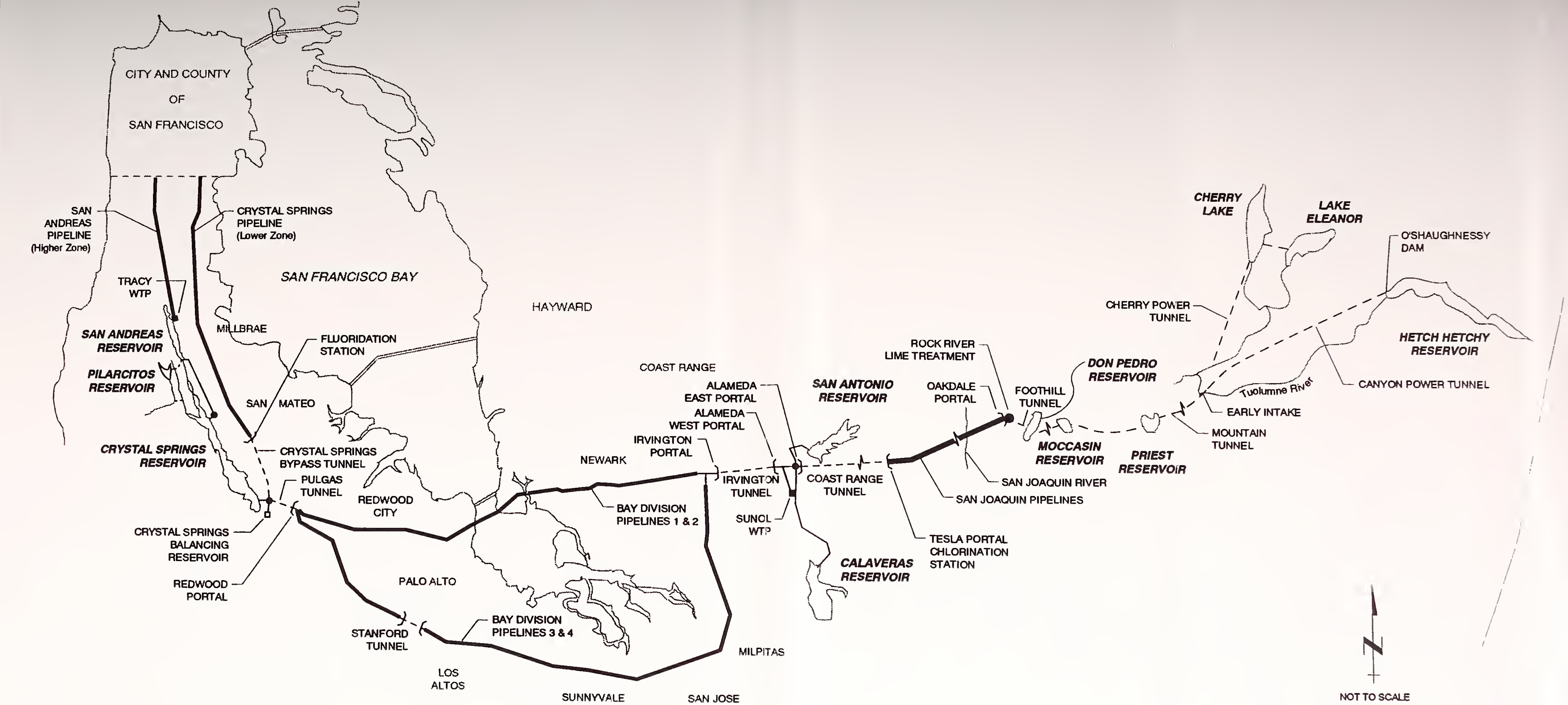
San Francisco Water Department

San Francisco Watershed Management Plans

Technical Memorandum No. 1
Prepared for EDAW, Inc.

April 1993

MONTGOMERY WATSON



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MONTGOMERY WATSON

San Francisco Watershed Management Plans

OVERVIEW OF SAN FRANCISCO WATER SYSTEM

FIGURE 1

feet is used in this TM for raw water storage; mgd and cfs are used for conveyance; mgal for treated water storage. Conversion factors of commonly used water units are provided here so that only one set of units is utilized each time in this TM.

1 ac-ft = 325,900 gallons
1,000 ac-ft/yr = .8927 mgd
1 mgal = 3.07 ac-ft
1 mgd = 1,122 ac-ft/yr
1,000 gpm = 2.23 cfs
1 cfs = 646,360 gpd

SAN FRANCISCO WATER SYSTEM

A description of the San Francisco (City) water supply, storage, transmission, and treatment facilities is provided below to aid in the understanding of this complex system. An overview of Water Department Division operations as they relate to the watersheds is provided in the second part of this memorandum.

Overview of San Francisco Water System

The San Francisco water system was originally conceived in the late 19th century and constructed during the early part of the 20th century. The system obtains water primarily from three sources: Tuolumne River via the Hetch Hetchy system in the Sierra Nevada mountains, local runoff in the Calaveras and San Antonio reservoir watersheds in the eastern San Francisco Bay Area, and local runoff in the Crystal Springs, San Andreas, and Pilarcitos reservoir watersheds on the San Francisco Peninsula. In addition, San Francisco obtains some water from groundwater basins in San Francisco, Pleasanton, and the Sunol Valley. Approximately 80 percent of the potable supply to SFWD customers is provided by the Hetch Hetchy watershed.

A schematic of the overall water system is presented in Figure 1. Water is conveyed to the San Francisco Bay Area from the Hetch Hetchy system across the San Joaquin Valley through a series of aqueducts and tunnels to Alameda County near the community of Sunol. Some of the Hetch Hetchy water is stored in San Antonio Reservoir; the remainder continues to flow through the Irvington Tunnel and the Bay Division Pipelines.

The local runoff from Calaveras and San Antonio Reservoirs is treated at the Sunol Filter Plant (WTP) and combined with the Hetch Hetchy water. This water is then conveyed across the San Francisco Bay (Bay) and distributed to wholesale customers along the way. Part of this water is stored in Peninsula reservoirs where it is blended with local runoff; the remainder is conveyed to wholesale customers along the Peninsula and individual customers within the City. The water stored in the Peninsula reservoirs is treated at the San Andreas WTP. This water continues on to San Francisco and provides a potable supply along the way.

The primary reservoirs in the system are listed in Table 1 along with the catchment areas and the reservoir storage capacities. SFWD owns most of the lands within each Bay Area catchment area; the Sierra catchment areas are within Stanslaus National Forest and Yosemite National Park. The catchment areas are similar to the total watershed areas except for Calaveras Reservoir; its watershed extends further south beyond SFWD properties. It should be noted that the Alameda Creek watershed (which includes the catchment areas of Calaveras and San Antonio Reservoirs) is approximately 600 square miles (sq mi). Using Sunol Dam as the easternmost point, this watershed extends as far south as Mount Hamilton, as far east as the Altamont Pass, and almost as far north as Mount Diablo. The areal extent of this watershed will be important in later tasks of the watershed management planning as the Sunol Valley is analyzed.

TABLE 1
SAN FRANCISCO WATER DEPARTMENT STORAGE RESERVOIRS

Primary Reservoirs	Maximum Capacity acre-feet	Maximum Capacity mgal	Catchment Area sq mi
Hetch Hetchy Watershed			
Cherry Valley	268,800	87,600	114
Eleanor	27,100	8,830	79
Hetch Hetchy	360,400	117,400	459
Alameda Watershed			
Calaveras	96,900	31,550	135 (1)
San Antonio	50,500	16,500	39.7
Peninsula Watershed			
Crystal Springs	58,400	19,020	24.6 (2)
Pilarcitos	3,100	1,010	4.3 (3)
San Andreas	19,000	6,190	6.9 (4)

(1) Includes 35 sq mi of Upper Alameda Creek catchment area.
(2) Includes 2.1 sq mi of Stone Dam catchment area.
(3) Does not include 0.6 sq mi from Pilarcitos side flume no longer in service.
(4) Includes 2.5 sq mi of catchment area along San Mateo

The SFWD provides water to approximately 2.15 million people, and was approaching an average daily consumption of approximately 290 mgal before the current drought. Approximately 80 mgd is currently utilized within the City and County of San Francisco, and approximately 130 mgd is currently provided to 30 wholesale water purveyors along the southern half of the San Francisco Bay, as presented in Figure 2. This reduced consumption from predrought conditions reflects the rationing restriction imposed on the consumers. The 30 water agencies which purchase wholesale potable water from San Francisco, together called the Bay Area Water Users Association, deliver it directly to the consumers. The members of the Bay Area Water Users Association are listed in Figure 2.

Hetch Hetchy System

Although the conveyance and storage facilities of the Hetch Hetchy system are not directly pertinent to the study currently undertaken, the following overview is provided for clarity. Only the primary facilities are presented in Figure 1. The lime treatment and chlorine stations located within the Hetch Hetchy system are discussed later under treatment facilities but are located in Figure 1.

Supply and Storage. The Tuolumne River, with its source in several glaciers on the 13,000 feet high Mount Lyell and Mount Dana, drains 713 square miles of watershed in rugged granite mountains which slope west from the Sierra Nevada crest. Over 90 percent of the watershed is at elevations above 6,000 feet. The Tuolumne River flows through the northern reaches of Yosemite National Park and through the Stanislaus National Forest. The river continues through the Sierra

eastern side of the Coast Range Mountains. The San Joaquin Pipelines Nos. 1, 2, and 3, were completed in 1932, 1953, and 1968 respectively. From the Tesla Portal, the water continues 25 miles through the Coast Range Tunnel to the Alameda East Portal, located approximately three miles south of the community of Sunol.

Normally Lake Eleanor water is diverted to Cherry Lake and these waters are conveyed through the Cherry Power Tunnel to the Holm Power House. The waters are then released into Cherry Creek which flows to the Tuolumne River to meet the requirements of MID and TID at Don Pedro Reservoir. If needed to supplement the Hetch Hetchy supply during an emergency, water from Lake Eleanor and Cherry Reservoir can be conveyed through Cherry Power Tunnel to other transmission facilities which connect with Early Intake, however, this diversion to the Hetch Hetchy system is not a normal operating proceedure.

Alameda Watershed System

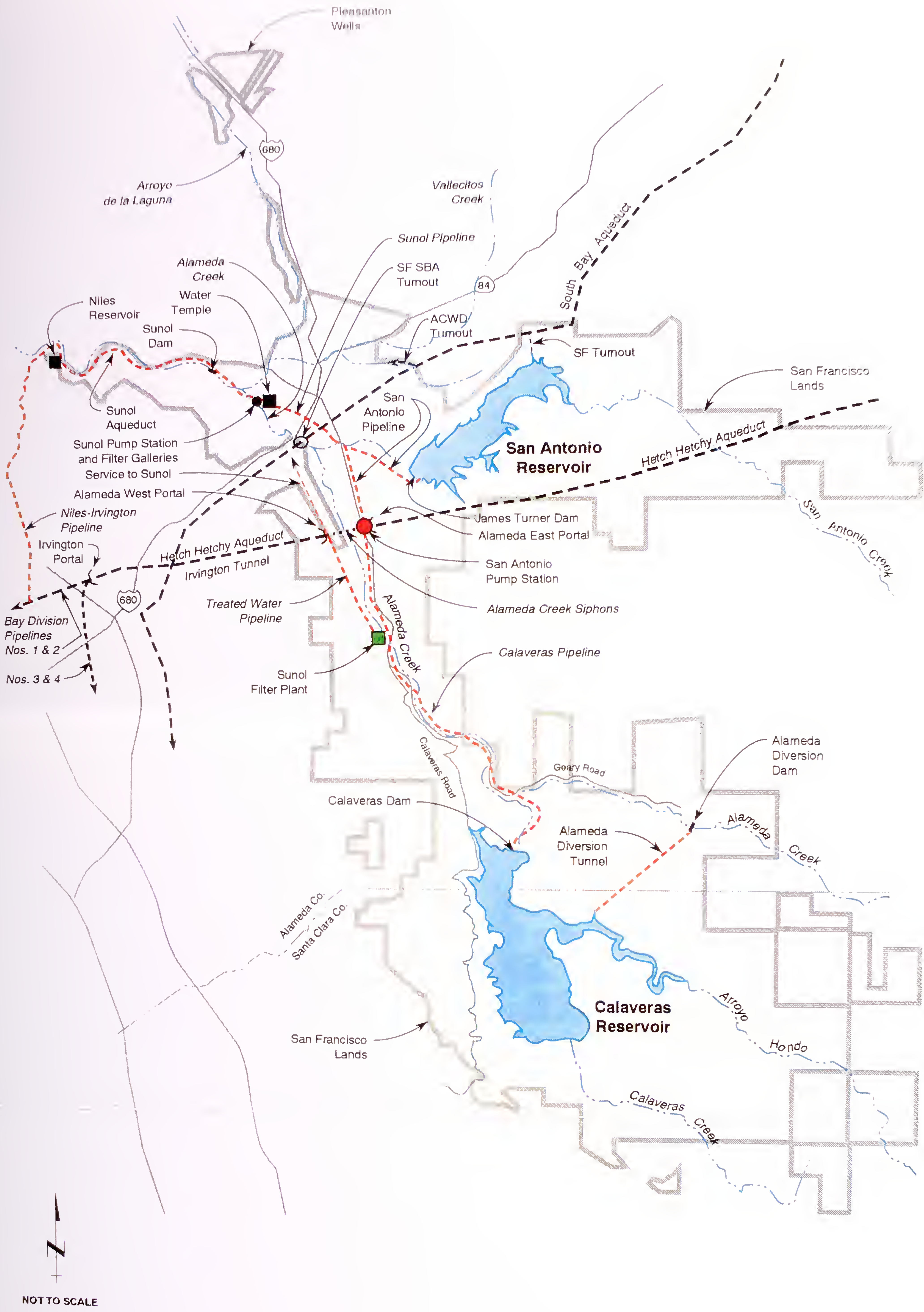
The two Alameda County reservoirs, Calaveras and San Antonio, are discussed here along with the transmission facilities between the reservoirs, the Sunol filter plant (described in more detail later), and other facilities within Sunol Valley, ending with the Irvington Portal. Figure 3 illustrates the Alameda System. A brief discussion of the Alameda County Water District (ACWD) is provided because of its use of Alameda Creek waters.

Calaveras Reservoir. Construction was started by the Spring Valley Water Company on the original Calaveras Dam in early 1913. A portion of the upstream face of the dam failed in 1918. The reconstructed dam was completed in 1925 over the Calaveras Creek, just below its confluence with Arroyo Hondo and upstream of its confluence with Alameda Creek. At the time of construction, the 215 foot earth filled dam was the highest in the world. Since Alameda Creek does not drain into Calaveras Reservoir, the Alameda diversion dam and tunnel were constructed following the completion of Calaveras Dam to divert Alameda Creek flows into the reservoir. This facility was completed in 1931 and is located to the northeast of the reservoir along Alameda Creek.

Calaveras Reservoir has a capacity of 96,900 ac-ft. The watershed for Calaveras Creek is approximately 100 square miles including 38 square miles for the Arroyo Hondo watershed, plus 35 square miles for the Alameda Creek watershed upstream of the diversion dam; 128 square miles of the 135 square miles of watershed lands are within Santa Clara County with the remainder in Alameda County.

San Antonio Reservoir. James H. Turner Dam and San Antonio Reservoir are the latest major additions to the San Francisco system, having been completed in 1965. The dam is across La Costa Creek, also referred to as San Antonio Creek, which is a tributary to Alameda Creek, downstream of the confluence of Alameda and Calaveras creeks. The reservoir has a capacity of 50,500 ac-ft and collects runoff from a watershed of 40 sq mi. It is used to store Hetch Hetchy water, the South Bay Aqueduct emergency water (discussed below), Calaveras Reservoir Surplus water (via the Calaveras Pipeline), as well as local runoff. In addition, facilities are available to pump groundwater to San Antonio Reservoir from the Sunol Filter Galleries via the Sunol pump station and pipeline and the San Antonio pipeline.

Pleasanton Wells. Approximately four miles north of Sunol, there are 17 wells located in the Pleasanton Well Field, which is on City property straddling Highway 680 in Pleasanton. This groundwater supply was first utilized in 1898. The Pleasanton/Sunol pipeline, a 30-inch pipeline, was constructed in 1909 to convey groundwater to the Sunol Water Temple. This pipeline was severed in the early 1960's. The remaining segment is currently used to collect well water from the SFWD's remaining Pleasanton lands and convey to Castlewood Country Club.



San Francisco Watershed Management Plans

ALAMEDA SYSTEM

FIGURE 3

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MONTGOMERY WATSON

Sunol Valley Groundwater. The Sunol Valley, south of the Pleasanton wells, is a gravel filled depression of about 1,300 acres at the upper entrance to Niles Canyon. The Alameda Creek drainage area of some 600 square miles includes waters from the catchment area of Arroyo de la Laguna to the north, Alameda Creek and Calaveras Creek drainage areas to the south, local groundwaters, and surface waters imported from the State Water Project via the South Bay Aqueduct for the ACWD as discussed below. Alameda Creek flows through Sunol Valley (that flow which is not diverted into the reservoirs), through the Niles Canyon, then becomes a flood control channel to the Bay. The water in Sunol Valley is surface water directly conveyed through the creeks, and surface and ground waters which have infiltrated into the gravelly valley soils. Since the Sunol Valley groundwater supply is heavily influenced by the surface water flowing from Alameda Creek, it is subject to surface water drinking regulations which are more stringent than groundwater regulations.

Sunol Dam, a 28 foot high concrete structure, was constructed in 1899 and is located on Alameda Creek about one mile west of Sunol. It is usually submerged but it holds back the creek flow to increase the recharge of water into the groundwater aquifer. In addition to Sunol Dam, filter beds, or groundwater recharge basins, were developed in 1900 near the Sunol Water Temple to increase the infiltration of rainfall.

The water in Sunol Valley percolates through the gravel beds and is collected in underground 36-inch perforated concrete pipes and conveyed through screened brass pipes to a concrete tunnel, called Filter Galleries. The Filter Galleries are approximately 9,000 feet long and parallel Alameda Creek. They begin at both the Sunol Dam and a point just west of Highway 680 and converge at the Sunol Water Temple. The Sunol Pump Station is located next to the Water Temple and when used, can pump groundwater from the Filter Galleries through the 36-inch Sunol Pipeline to the San Antonio Pipeline where it can be conveyed to San Antonio Reservoir or to the Sunol WTP. The water can also be conveyed through the Sunol Aqueduct to Niles Reservoir.

The Sunol Aqueduct was constructed in 1900 first as a flume, replaced by a concrete box in 1923, to supply water from the Filter Galleries to the Peninsula via Niles Reservoir within the Niles Canyon. The aqueduct alignment is adjacent to and within the Alameda Creek bed and terminates at the Niles Reservoir in Fremont. The aqueduct is currently being studied to determine the adequacy of long term usage. From the Niles Reservoir, the Niles-Irvington 44-inch pipeline, which can reverse the direction of flow, continues along an easement in railroad company right-of-way and travels south to its terminus at the Bay Division Pipelines Nos. 1 and 2 at the Irvington Pump Station. The Sunol Aqueduct and the Niles-Irvington Pipeline have limited usage at the present time.

South Bay Aqueduct Supply. The City has been purchasing State water from the emergency water bank during the previous several years of the current drought to augment its surface supplies. This water is conveyed from the State storage facilities north of the Sacramento River-

San Joaquin River Delta (Delta), through the Sacramento River and Delta rivers, to the Clifton Court Forebay, a regulating reservoir. It is then pumped through the Banks Pumping Plant near the City of Tracy to Bethany Reservoir.

The water is pumped into the South Bay Aqueduct (SBA), a 43-mile system of pipelines, canals, and tunnels which convey State water to the three primary SBA water contractors: the ACWD, the Santa Clara Valley Water District, and the Alameda County Flood Control and Water Conservation District - Zone 7, all located within Alameda and Santa Clara counties. The Aqueduct winds its way from Bethany Reservoir south around the Livermore Valley with a connection to Del Valle Reservoir (a State storage facility), then across the northern end of San Antonio Reservoir. It continues across Sunol Valley parallel to Highway 680 and into Fremont, Milpitas, then terminates in a storage tank in San Jose.

There are two ACWD turnouts for SBA water. One is north of San Antonio Reservoir at Vallecitos Creek. Vallecitos Creek is a tributary of the Arroyo de la Laguna which crosses Sunol Valley to its junction with Alameda Creek and continues through Alameda Creek in Niles Canyon to the ACWD groundwater recharge facilities over the Niles Cone aquifer. The other turnout is to the south of Niles Canyon; this turnout provides water directly to the existing ACWD WTP and to the WTP under construction. As the new WTP increases its production, more water will be diverted from the SBA at this turnout, resulting in a reduction of ACWD's diversion conveyed through Alameda Creek. The ACWD has an agreement with SFWD to manage some of the Niles Canyon properties to control land use activities which could impact the Alameda Creek supply.

Although there are only three primary SBA water contractors, as mentioned above, the State also delivers water through the SBA on an interim or short-term basis. When San Francisco requests water from the State emergency water bank, it is conveyed through the SBA to a turnout at the north end of San Antonio Reservoir. This turnout conveys the water through a pipe to the outlet located along a small tributary which drains into the San Antonio Reservoir. There is also a SFWD turnout near where the SBA crosses Alameda Creek. A short segment of pipe conveys the emergency water to the Sunol pipeline; the SBA water has enough pressure to flow to the Sunol filter plant without being pumped. This emergency SBA turnout will be removed when the current drought is over.

Transmission to the Irvington Portal. From the Alameda East Portal, Hetch Hetchy water is transported 3,000 feet across the Sunol Valley in three parallel siphons under Alameda Creek to the Alameda West Portal. The Alameda West Portal is the entrance to the Irvington Tunnel, a segment of the Hetch Hetchy Aqueduct. Described here is the transfer of water from the Hetch Hetchy Aqueduct into the Alameda system and back into the aqueduct.

Hetch Hetchy water can be transferred from the Alameda Creek Siphon No. 3 into San Antonio Reservoir via the San Antonio Pump Station and the 60-inch San Antonio Pipeline. Hetch Hetchy water can be conveyed to the Sunol WTP through the Calaveras Pipeline via the San Antonio Pump Station, which has a capacity of 160 mgd, but cannot be transferred to Calaveras Reservoir due to its higher elevation. The Calaveras Pipeline is also used to convey water by gravity from the Calaveras Reservoir outlet tower to San Antonio Reservoir. This pipeline is located parallel to Alameda Creek with several creek crossings.

All of the water from San Antonio and Calaveras Reservoirs is treated at the Sunol WTP. The San Antonio Reservoir can feed water by gravity into the Sunol plant when the water in that reservoir is at a very high elevation, otherwise it must be pumped through the San Antonio Pump Station. Water from the Calaveras Reservoir flows by gravity to the Sunol WTP. From the Sunol WTP, a 78-inch pipeline, parallel to Alameda Creek on the west bank, conveys treated water 1.7 miles to Alameda Creek Siphons Nos. 2 and 3 where it is blended with the Hetch Hetchy aqueduct water. The three siphons have a capacity of 67, 134, and 152 mgd. Some of this treated water continues past the siphons and is supplied directly to customers in Sunol.

The Calaveras pipeline provides operational flexibility by allowing water to be conveyed quickly from Calaveras Reservoir or San Antonio Reservoir to the Sunol WTP. This pipeline provides redundancy in the system in the event of a Hetch Hetchy aqueduct outage in which case the reservoir waters can be utilized up to the 160 mgd capacity of Sunol WTP.

Alameda System Operations. During normal weather years, the desired operation of the Alameda reservoirs is to keep the storage low enough on December 1 of each year to capture the average year runoff. By June 1, the reservoirs should be full. The Calaveras Reservoir fills entirely from local runoff and is usually full by April during average weather years.

Aeration facilities have been constructed in Calaveras Reservoir to pump air to the zones of stagnation created at the bottom of this deep reservoir. These facilities have not been used extensively yet. When in operation, the aeration facilities will pump in air to increase the dissolved oxygen which has been depleted due to decaying organic sediments.

Bay Division Pipelines

Hetch Hetchy and Sunol WTP water is conveyed from the Alameda West Portal through the Irvington Tunnel to the four Bay Division Pipelines. Bay Division No. 1 and No. 2 cross under the Bay to the Peninsula while Bay Division No. 3 and No. 4 skirt the southern end of the Bay to the Peninsula. The BAWUA members between the Irvington Portal at the City of Hayward and the Pulgas Tunnel on the Peninsula are supplied water from the Bay Division Pipelines.

Meters are on each pipeline west of the Irvington Portal and east of the Pulgas Tunnel to enable the operators at the Sunol WTP to react to the system demands along the Bay Division Pipelines. The Bay Division Pipelines join at the Pulgas Tunnel.

Peninsula Watershed System

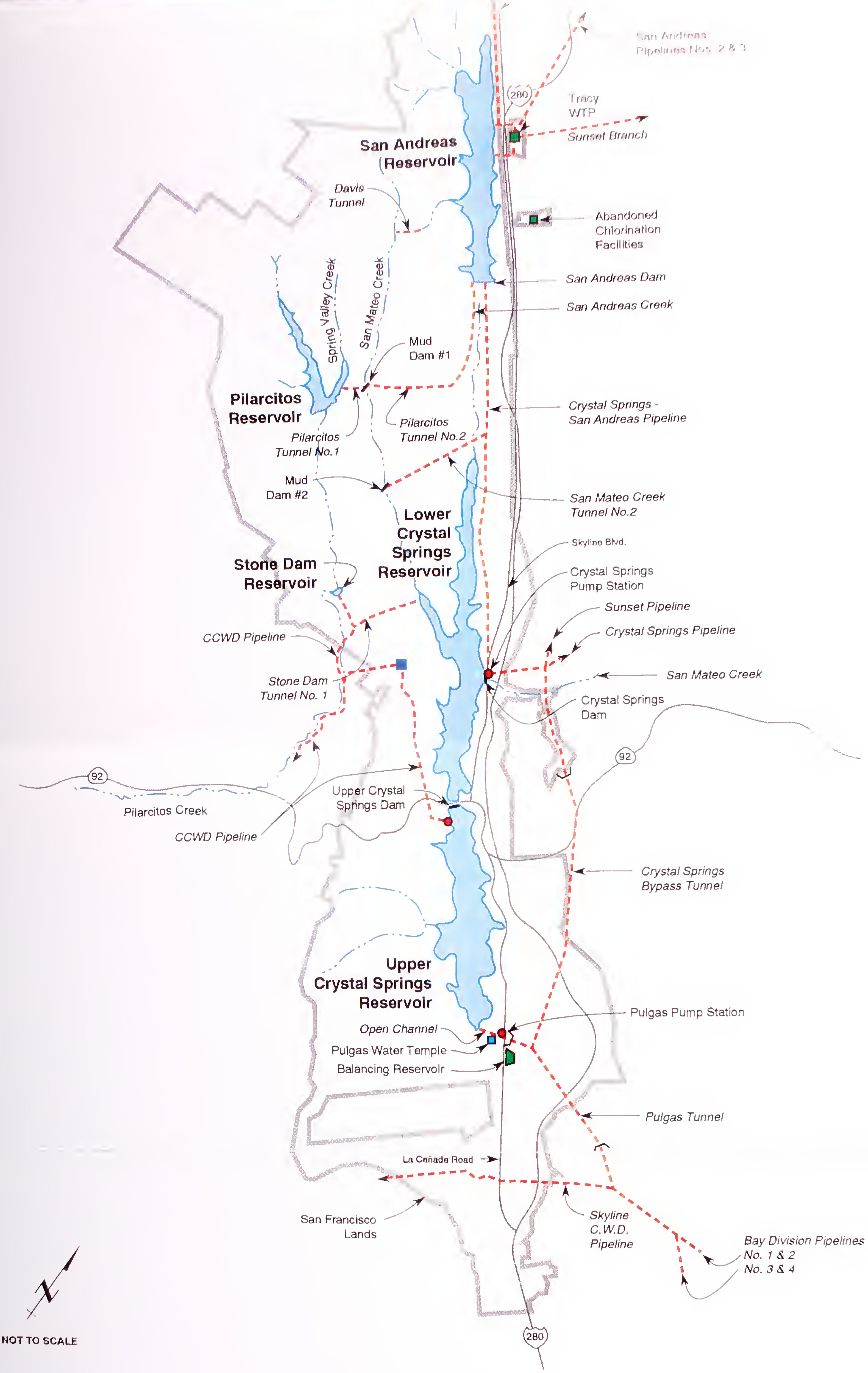
Water conveyed through the Bay Division Pipelines to the Peninsula is either stored in San Andreas and Crystal Springs Reservoirs and is treated at the San Andreas filter plant or it continues north along the Peninsula to the City. Described here is the Peninsula system starting at the Pulgas Tunnel. This description also includes the Pilarcitos watershed. Figure 4 illustrates the Peninsula system.

Pilarcitos Reservoir and Conveyance Facilities. The SFWD owns 23,000 acres of watershed lands east of Montara Mountain. San Francisco has water rights to the waters in the upper reaches of Pilarcitos Creek. The City utilizes most of this supply to provide water to the Coastside County Water District (CCWD), which serves the Half Moon Bay area. The City also has riparian water rights to the lower reaches of Pilarcitos Creek and its tributaries. The Pilarcitos Reservoir is important to the City because it provides an emergency gravity flow supply to San Andreas and Crystal Springs Reservoirs.

In 1864, the Spring Valley Water Company completed a dam impounding the waters of the south branch of Pilarcitos Creek and through a system of flumes and pipes, brought the water 32 miles to Laguna Honda Reservoir in San Francisco to augment its supply from local wells and springs. A new Pilarcitos Dam was constructed on the north and south branches of Pilarcitos Creek in 1866 which was then raised slightly in 1874; the main Pilarcitos Dam caused the inundation of the original dam. Pilarcitos Reservoir has a catchment area of 3.8 square miles and a capacity of 3,100 ac-ft. Heavy rainfall exceeding 40 inches a year can be expected around the reservoir. The storage in Pilarcitos Reservoir is limited and needs to remain high in order to meet the water demands of CCWD and potential emergencies in San Francisco.

During times of surplus runoff, water is diverted by gravity from the north side of Pilarcitos Reservoir through the Pilarcitos Tunnel No. 1 to San Mateo Creek. Here the upper San Mateo Creek waters and the Pilarcitos Reservoir diversions are either conveyed through the Pilarcitos Tunnel No. 2 to San Andreas Reservoir or flow down San Mateo Creek to Crystal Springs Reservoir.

Water is released for CCWD from Pilarcitos Lake to Pilarcitos Creek which conveys it to Stone Dam Reservoir. Stone Dam was built around 1871 and is a diversion dam located two miles downstream of Pilarcitos Dam. It has a catchment area of 2.1 square miles and has a storage capacity of 15 ac-ft.



San Francisco Watershed Management Plans

PENINSULA SYSTEM

FIGURE 4

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MONTGOMERY WATSON

During times of surplus precipitation this lower Pilarcitos Creek runoff is diverted from the inlet at the reservoir through Stone Dam Tunnel No. 1 to San Mateo Creek to Crystal Springs Reservoir. The system originally had a series of flumes and aqueducts from the outlet of Tunnel No. 1 to San Andreas Reservoir, but these facilities are abandoned. Diversions for CCWD are made from Tunnel No. 1 before the water is conveyed out of the watershed. This CCWD pipeline is connected to a new CCWD pipeline which conveys water pumped from Upper Crystal Springs Reservoir west to the CCWD's WTP. This new pipeline allows CCWD to obtain water from either the Pilarcitos system or from Crystal Springs Reservoir.

Crystal Springs Reservoir. The Upper Crystal Springs Reservoir was formed after the construction of the Upper Crystal Springs Dam in 1877. Lower Crystal Springs Reservoir was formed in 1890 after the Crystal Springs Dam was placed on San Mateo Creek below the confluence of its main branches. The original outlet from the Upper Reservoir was damaged during the 1906 earthquake; 20 feet of pipeline were fractured by a lateral earth movement of 5.5 feet. The Upper Dam no longer separates the lakes into two water bodies but is used as support for the Highway 92 roadbed with a culvert underneath; the resulting Crystal Springs Reservoir now has unregulated flow between the upper and lower reservoirs.

The newer (1890) Crystal Springs Dam is an arched dam built of interlocking concrete blocks. Concrete was needed because there was no supply of high quality rock proximate to the site, and a very strong and high dam was needed. Blocks were utilized because concrete had a tendency to shrink and crack when pored and set in large masses. This dam is designated as a California Historic Civil Engineering landmark because of the interlocking block design; it is also a marvel because it is as structurally sound today as the day it was completed. Skyline Boulevard was later constructed over Crystal Springs Dam. The Crystal Springs Reservoir has a capacity of 69,320 ac-ft but is operated at 58,400 ac-ft due to dam safety requirements. The catchment area is 22.5 square miles.

San Andreas Reservoir. The San Andreas Reservoir was created on the San Andreas Creek in 1870 with the completion of San Andreas Dam. It collects runoff from a watershed of 4.4 square miles and its current capacity is 19,000 ac-ft. The San Andreas fault passes under the eastern abutment of the dam but there was no significant damage to the dam during either the 1906 or 1989 earthquakes.

Transmission Facilities from the Pulgas Tunnel to the City. The transmission and related facilities located between the Bay Division Pipelines and the City are very extensive and are described below by system segments. It should be noted that the first Hetch Hetchy water flowed into Crystal Springs Reservoir on October 24, 1934.

Pulgas Tunnel. At Pulgas Tunnel, the water from the Bay Division Pipelines is transferred to either the Balancing Reservoir, Crystal Springs Bypass Tunnel, or Upper Crystal Springs Reservoir. The 60 mgal Crystal Springs Balancing Reservoir is used to regulate the daily cycle of flows and pressures in the system. When the supply at Pulgas Temple, leading to Crystal Springs Reservoir, exceeds the demand the pumps at the Pulgas Pump Station are activated to refill the Balancing Reservoir. If the Balancing Reservoir is full, excess flows spill into the Upper Crystal Springs Reservoir. When demand from San Francisco and the Peninsula exceeds the supply at Pulgas Temple, water is released from the Balancing Reservoir into the Pulgas Tunnel and is conveyed to the Crystal Springs Bypass Tunnel.

Crystal Springs Bypass. Water conveyed from the Bay Division Pipelines which does not spill into Crystal Springs Reservoir travels by gravity through the Crystal Springs Bypass Tunnel and is routed through the Crystal Springs Pipelines No. 2 and No. 3 and the Sunset Supply Pipelines. These pipelines convey water directly to water purveyors along the Peninsula and into the City.

Crystal Springs and San Andreas Pump Stations. The Crystal Springs Pump Station and the 60-inch Crystal Springs-San Andreas Pipeline is used to transfer up to 75 mgd from Crystal Springs Reservoir to San Andreas Reservoir. Water is diverted from two outlets from the San Andreas Reservoir (No. 2 and No. 3) and is pumped to and treated at the San Andreas WTP. This WTP has a capacity of 180 mgd and is used to supply upper elevation customers from Millbrae to the Sunset Reservoir in the City through the 54-inch San Andreas Pipelines No. 2 or No. 3.

Delivery to the City. In addition to the San Andreas Pipelines, water is delivered to the City via the 20-mile long Sunset Pipeline and the Crystal Springs Pipelines, and is placed in three potable water terminal storage reservoirs: Sunset, Merced Manor, and University Mound. From here, the City's distribution system delivers water directly to consumers. Demand changes from Pulgas Temple to the City are detected by monitoring the rate of water level changes at the above mentioned storage tanks in the City, at Pulgas Temple, by meters east of Pulgas Tunnel, and at the City limit.

Peninsula System Operations. The desired operation of San Andreas Reservoir is to keep the storage here as high as possible by transferring water by gravity from Pilarcitos Reservoir and by pumping water from Crystal Springs Reservoir through the Crystal Springs Pump Station and transfer pipeline. The goal at the beginning of December is to have the combined storage for the Peninsula reservoirs at not more than 60,000 ac-ft in storage, or 20,000 ac-ft below the total storage. The goal for the storage level at the end of April is to maximize the local storage. If these goal operating levels cannot be met, then flows from the Hetch Hetchy and Alameda system will be transferred into Crystal Springs Reservoir as demand and pipeline capacity permit. However, as demands increase during the summer months, and because demands continue to increase on an annual basis, it becomes more and more difficult to make these inter-reservoir transfers.

Treatment Facilities

Since water from the local reservoirs must be filtered before augmenting the Hetch Hetchy water supply, SFWD constructed and operates filtration facilities within both the Alameda system and the Peninsula system. Both facilities provide for the removal of turbidity (particulates), disinfection, and corrosion control. Disinfectant is added for microbiological control prior to filtration or added to the filtered water, to provide a residual for the distribution system. The Hetch Hetchy water is currently not filtered, but for disinfection and corrosion control purposes the water is treated at several points along the aqueduct. The treatment facilities for the SFWD system are described below and their locations illustrated in Figure 1.

Sunol Filter Plant. The Sunol WTP provides conventional treatment of local runoff which is stored in Calaveras and San Antonio Reservoirs. As discussed previously, the Calaveras Pipeline and San Antonio Pipeline are utilized to transport water from the two reservoirs to the treatment facilities. Hetch Hetchy water can also be treated at this plant, if necessary. Hetch Hetchy water needs filtration only during times of turbid (cloudiness due to fine suspended sediment) water, usually in winter months. The Sunol WTP can treat up to 160 mgd. This facility disinfects with sodium hypochlorite and adjust pH with sodium hydroxide for corrosion control.

San Andreas Filter Plant. The San Andreas WTP started operation in 1972 and was recently modified to increase its capacity from 80 mgd to 180 mgd. The existing plant was designed for the full treatment of water but is often operated as a direct filtration plant due to the high quality of the water entering it. Sodium hypochlorite is used to disinfect the water and sodium hydroxide is used to adjust the pH. Fluorosilicic acid is also added at the WTP to provide fluoride in this treated water. This facility is used to supply upper elevation customers from Millbrae to the Sunset Reservoir in the City through the San Andreas Pipelines.

Additional Treatment Facilities. In addition to the two WTPs, there are several treatment facilities within the system. These facilities can be located in Figure 1. Hetch Hetchy water is first treated with lime (calcium hydroxide) at Rock River, near Oakdale in Stanislaus County. This raises the pH and adds calcium to control corrosion in the system. It is next disinfected with sodium hypochlorite at Tesla Portal. At the Alameda siphons, this treated Hetch Hetchy water is blended with water from the Sunol filter plant; about 85 percent is still Hetch Hetchy water as it is conveyed through the Irvington Tunnel. This water is distributed to East and South Bay customers and to lower elevations on the Peninsula, as well as San Francisco customers (this water directly meets 25 percent of the City's demands). Fluorosilicic acid is added to Hetch Hetchy water along the Crystal Springs Bypass Pipeline, so all points north of the Crystal Springs Bypass receive fluoride in their water. The remaining water is conveyed from the San Andreas filter plant to the upper elevations on the Peninsula and to the City distribution storage tanks. Most of the storage tanks are chlorinated again on the outlet side using chlorine or sodium hypochlorite.

In addition to the treatment facilities described above, SFWD adds copper sulfate to the four primary reservoirs, Calaveras, San Antonio, Crystal Springs, and San Andreas, to control the development of algae which clogs the filters at the filter plants. The copper sulfate is added to the reservoirs on an as needed basis usually no more than two times per year; typically once a year for each reservoir.

DESCRIPTION OF DEPARTMENT FUNCTIONS

As presented in Figure 5, the San Francisco Public Utilities Commission oversees the functions of the SFWD, the Hetch Hetchy Project, the Municipal Railway Department, and various Bureaus. This section provides an overview of the primary divisions within the SFWD with a brief description of the Hetch Hetchy Project and Utilities Engineering Bureau (UEB) as their functions relate to the Water Department.

Utilities Engineering Bureau

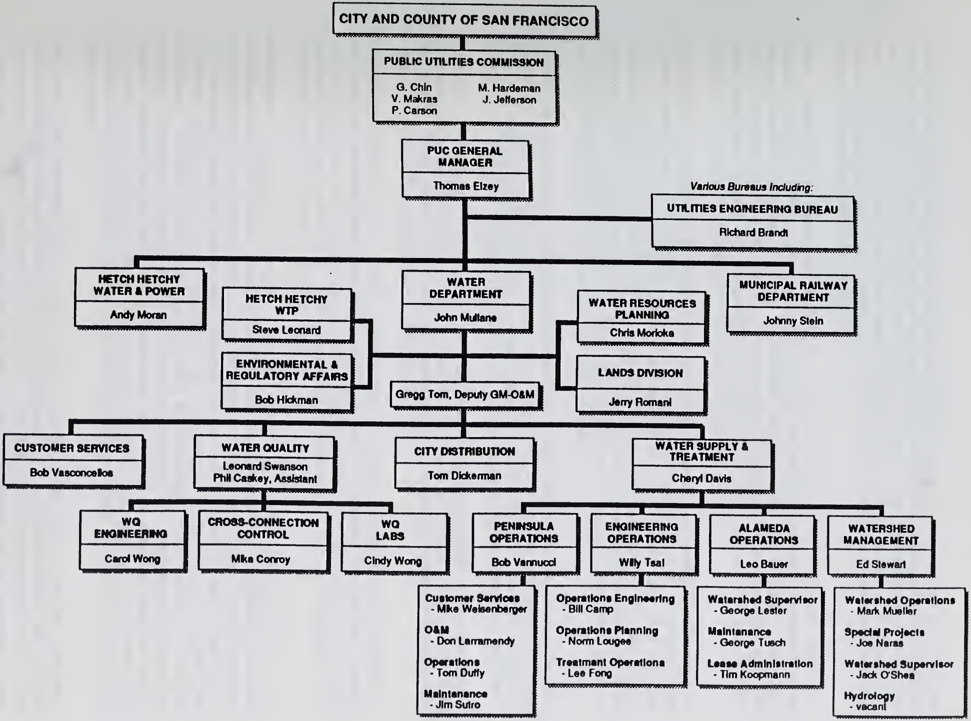
The UEB is responsible for designing and constructing major capital improvement projects. This bureau is staffed with design engineers who conduct or contract for specific engineering, environmental, construction management, and related services for the Water Department, the Hetch Hetchy Project, and the Municipal Railway Department to implement components of the Public Utility Commission's major capital improvement plans.

Hetch Hetchy Project

The Hetch Hetchy Project manages the Sierra Nevada watersheds and reservoirs and water conveyance facilities as far west as the Alameda East Portal of the Coast Range Tunnel. This department also manages the power production and transmission facilities from the Sierra's to the Newark Substation where PG&E then wheels the power for the City. The Hetch Hetchy Project supplies the pre-arranged flow of water from the Hetch Hetchy system to the SFWD system at the Alameda East Portal. The flow rate is set by the Water Department and is limited to the capacity of the three San Joaquin Pipelines. Depending on the seasonal demand and the water levels at the primary storage reservoirs, the SFWD may request changes of flow rate four to five times a year.

Water Department

The SFWD manages the water system downstream from the Alameda East Portal, which includes all of the local sources of supply, transmission, water treatment, distribution, and billing. In addition, the Rock River lime treatment and Tesla Chlorination station are managed by SFWD.



San Francisco Watershed Management Plans

WATER DEPARTMENT ORGANIZATION

FIGURE 5

Within the Water Department are several primary divisions and sections. The primary divisions which are involved in the Watershed Management Plan process are Water Supply and Treatment and Water Quality. The sections which may also be involved in the planning process include the Hetch Hetchy WTP, Lands, and Environmental and Regulatory Affairs sections. The remaining sections, Customer Services, City Distribution, and Water Resources Planning are not expected to contribute to the watershed planning process.

Water Supply and Treatment Division. The Water Supply and Treatment Division is headquartered at the Millbrae office and is responsible for the operation and maintenance of the storage, treatment, transmission, and distribution facilities from the Alameda East Portal downstream to the San Francisco County line where the City Distribution Division takes over. The Water Supply and Treatment Division is further divided into the Engineering Operations, Alameda Operations, Peninsula Operations, and Watershed Management sections.

Engineering Operations Division. The Engineering Operations Division is responsible for all water supply and system planning and engineering, and the operation of the physical facilities and system between the Alameda East Portal and the San Francisco County line (plus the Rock River lime treatment and Tesla Portal chlorination station). The operation of the filter plants, treatment facilities, and pump stations are also under this division although activities involving these facilities are coordinated with the Water Quality Division. Capital improvement plans are developed in this Division in conjunction with other sections.

The Engineering Operations Division works closely with the Alameda and Peninsula Operations Sections because the operations and maintenance staff can be found in the geographically based groups. Land engineering functions are also conducted by this division; these responsibilities include interacting with developers for construction easements and maintaining property records.

Alameda Operations. This section is responsible for the daily operations and maintenance of the system and watershed areas west of the Alameda East Portal and east of Coyote Creek (along Bay Division Pipeline Nos. 3 and 4) and the Dumbarton Valve House (Bay Division Pipeline Nos. 1 and 2), except for the pump stations and the Sunol WTP.

Peninsula Operations. This section is responsible for the daily operations and maintenance of the system and watershed areas west of Coyote Creek (along Bay Division Pipeline Nos. 3 and 4) and the Dumbarton Valve House (Bay Division Pipeline Nos. 1 and 2), except for the pump stations and the San Andreas WTP. All customer meters outside of the City are maintained by the Peninsula Operations Customer Services section.

Watershed Management Section. This Watershed Management Planning effort is being coordinated from this section. Responsibility for the management of the Alameda and Peninsula watershed areas is the primary function of the Watershed Management section. Some members of the Watershed Management section are Registered Professional Foresters licensed by the State of California, fulfilling the State's requirement for management of the wildlife resources and watersheds. Watershed policy and project plans are developed by this section. Watershed protection, operations, maintenance, restoration, improvement, and enhancement activities are planned, reviewed, and/or approved by this section. Day to day execution of these activities is performed by the Alameda and Peninsula Operations Sections. In addition, Lands section staff (discussed below) administer activities on watershed lands performed by lessees and other third party interests.

The duties of the watershed keepers are as varied as patrolling for security problems, performing lake level readings, and maintaining ongoing relations with the County Departments, the California Department of Forestry, and recreation districts. The Watershed Management section is also responsible for specific technical studies such as hydrological studies, and for overseeing special

projects related to land use activities within the watersheds. This group coordinates specific tasks with the Water Quality Division such as developing a water quality monitoring program and addressing hazardous materials issues.

Water Quality Division. The Water Quality Division is also headquartered in Millbrae and is responsible for water quality throughout the entire system, including Hetch Hetchy. This division also operates the laboratory, and is responsible for cross connection control.

Lands Section. The Lands Section is responsible for leases and permits for SFWD lands within the watersheds and rights-of-way. The manager of the Lands section does not report directly to the Water Supply and Treatment Division, however, several Lands Section staff report to the Alameda Operations Manager on a daily basis.

Other Divisions. The City Distribution Division is headquartered at 1990 Newcomb Avenue in San Francisco and is responsible for distribution engineering, construction, and maintenance throughout the City and County of San Francisco.

The Customer Service Division is headquartered at 425 Mason Street in San Francisco and is responsible for customer services and accounts, the water rationing program, and field services.

The Water Resources Planning Division is headquartered at the Mason Street office and is responsible for water rates and budgets and water conservation programs, in addition to long term water resource management planning.

Appendix C-3

Technical Memorandum #2
Water Quality Vulnerability Zone Development
March 1994

San Francisco Water Department

San Francisco Watershed Management Plans

Technical Memorandum No. 2
Prepared for EDAW, Inc.

July 1996

MONTGOMERY WATSON

MONTGOMERY WATSON

TECHNICAL MEMORANDUM NO. 2

TO:	Ed Stewart, SFWD Dave Blau, EDAW Tina Stott, EDAW	**DATE:**	Updated July 22, 1996 March 25, 1994
PREPARED BY:	Karen Johnson Carol Ruth James	**CLIENT:**	EDAW, Inc.
REVIEWED BY:	San Francisco Water Department Watershed Planning Committee and Technical Advisory Committee	**FILE:**	637.0040
SUBJECT:	Water Quality Vulnerability Zone Development		

INTRODUCTION

Technical Memorandum No. 2 summarizes the development process for the water quality vulnerability zone maps. This memorandum is divided into two sections:

- A section which describes the natural watershed characteristics which influence each water quality parameter group of concern, and
- A section which discusses the method used for compositing the natural watershed characteristics into water quality parameter vulnerability zone maps.

In order to develop a tool for determining watershed lands vulnerable to current and future activities within the San Francisco Water Department's Peninsula and Alameda watersheds, five water quality parameter groups were selected for the evaluation. These water quality parameter groups were selected based on current and potential water quality regulations, industry-wide water quality issues, and the current activities within each watershed. The five groups include: particulates, synthetic organic compounds (SOCs) and pesticides, microorganisms, trihalomethane (THM) precursors of concern, and nutrients (nitrogen and phosphorus).

For each of these five water quality parameter groups, appropriate watershed characteristics were evaluated regarding their potential influence on the concentrations of these parameter groups in the watershed waterbodies. The two influences are the transport of the parameter group and the parameter group as a "contaminant" source. The watershed characteristics evaluated include: soils, slope, vegetation, proximity to water bodies, and wildlife concentrations (including cattle). The relative importance of each of these characteristics for each water quality parameter group is summarized.

The goal of this evaluation is to develop a composite vulnerability zone map of the water quality parameter groups for each watershed. These vulnerability zone maps identify those areas in the watershed which are considered high, medium, and low vulnerability zones with regards to their potential for increasing the concentration of a particular water quality parameter group in the receiving waterbodies. When considering new or reconsidering existing activities in the watershed, the high vulnerability zones, in particular, should be managed to avoid any potential for water quality degradation.

In order to develop the water quality vulnerability zone maps, GIS data for each characteristic were evaluated and ranked as high, medium, and low and plotted on a separate GIS data-interpreted layer. These layers were then combined and an overall high, medium, and low vulnerability zone map was developed for each water quality parameter group. A discussion of the development of these layers for each water quality parameter group is provided in the "Water Quality Parameter Groups" section.

Activities within the waterbodies were not analyzed in this study but should be considered in the overall management of the watershed. For example, birds which use the waterbodies, particularly waterfowl, defecate directly into the waterbodies and, therefore, may have a direct impact on water quality.

CONCLUSIONS

Composite water quality vulnerability zones were developed for the five water quality parameter groups - particulates, SOCs and pesticides, microorganisms, THM precursors of concern (surrogate for all disinfection by-product precursors), and nutrients. These vulnerability zones were defined based on four physical characteristics of each watershed - soils, slope, vegetation, and proximity to water. Through this analysis it was determined that inadequate data exists regarding wildlife movement within the watershed, and the proximity to water characteristic includes a broad enough boundary around all water bodies (reservoirs and streams, including intermittent streams) such that a separate wildlife concentration area need not be defined at this time. However, as additional wildlife information becomes available in the future, a wildlife vulnerability zone should be developed. Another finding is that the available data for both THM precursors of concern (i.e. organic carbon) and nutrients are limited to the extent that the vulnerability zones for these two water quality groups are identical. In order to better define these two water quality zones, monitoring for total organic carbon, nitrogen, and phosphorus would need to be inititated.

Ultimately the water quality vulnerability zones were composited based upon the approach summarized below.

- The high vulnerability areas defined for the "proximity to water" layer take precedence and, therefore, are defined as high vulnerability zones on all water quality composite maps.
- For other areas to be defined as a "high", slope must be high and either soils or vegetation must be high.
- For areas to be defined as a "low", two of either slope, soils, or vegetation must be low.
- All other areas not already defined based on the three points above are defined as medium.

Verification of this approach was achieved by using evaluation tools from both the agricultural (Universal Soil Loss Equation) and forestry (Erosion Hazard Rating) industries. The agricultural tool was the most compatible because of its emphasis on soils (such as clays) which can be more easily transported through water and cause treatment related water quality problems. Both evaluation tools placed importance on slope and its potential for impacting water quality. As a

result of the verification step, the water quality vulnerability zones have been finalized and are now being used in the development and analysis of the watershed management plan alternatives.

In final, it will be important for a watershed/reservoir monitoring program to be developed and initiated as soon as is possible. A water quality baseline is important to establish in the near term for two reasons. First, an assessment can be made regarding the water quality of the sources as they enter the SFWD-owned portion of the watersheds - particularly the Alameda Watershed. 'Two-thirds of the Alameda Watershed are owned by other parties and, therefore, SFWD cannot directly control the water qualities influenced by these properties.

Second, once a watershed management plan is established, monitoring will be a tool for evaluating the plan. Having a baseline of data and a monitoring program which is established for this assessment will be important. Current monitoring programs do not address this need.

WATER QUALITY PARAMETER GROUPS - IMPACTS OF NATURAL WATERSHED CHARACTERISTICS

Particulate Vulnerability Zone

The impact of each of the following watershed characteristics on particulate vulnerability was defined by the tendency of the characteristic to influence particle transport.

- **Soils** - high, medium, and low classifications for soils were defined based on the inverse of the dry density of each soil type. Dry density refers to the mass (weight) of a unit volume of dry soil. Dry density was chosen over both bulk (includes solids and pores) and particle density (includes solids) because of its universal use and availability. In addition, it was assumed that the highest increase of particulates into the waterbodies due solely to the soil-type occurs with the first major storm event when the dry density is more apt to represent the soils. In general, clays which have a low dry density are classified as high, loams which have a medium dry density are classified as medium, and sands/gravels which have a high dry density are classified as low.

- **Slope** - high, medium, and low classifications for the slope ranges were defined based on the US Forest Service classifications for debris slumping or increased particle transport. These slope ranges are different than those used for sediment yield analyses (debris avalanche). In sediment yield analyses the evaluation is focused on mass loadings of sediment.

high	greater than 30 %
medium	15 to 30 %
low	0 to 15 %

- **Vegetation** - high, medium, and low classifications for vegetation were determined based on the ability of the different vegetation communities to provide a protective layer (intercept the kinetic energy) between rainfall and soil and to a lesser degree, stabilize the soils with the presence of leaf debris and roots. Given this line of reasoning, forested areas were considered the most protective (low), woodlands, scrubs and chaparral medium (medium), and grasses the least protective (high).

- **Proximity to Water** - the "proximity to water" boundary was established based on three sources of information -- other watershed investigations, rainfall intensity, and time of concentration.

  Watershed Investigations - most current "proximity to water" information pertaining to watershed studies identifies buffer zones for development purposes as a filter barrier for protecting water quality. Information pertaining to watershed studies documented in the AWWA Effective Watershed Management manual and a study conducted in Taiwan which,

in part, addressed this issue, were used. A range of 50 to 300 feet was ascertained as the distance required to adequately impede the movement of particulates, nutrients, and pesticides into the watershed waterbodies. This range of distances would also be adequate for the control of microorganisms - impeding their movement into the water bodies. These distances, of course, are greatly impacted by type of vegetation, slope, and soil types. However, these physical watershed characteristics are addressed in this analysis.

Reduction of the 300-foot distance is possible if establishing buffer zones as a control mechanism for land development is the goal of a particular study. However, in the San Francisco study, because protection of water quality is the predominant goal, the use of the 300-foot distance as the baseline proximity boundary is both defensible and considered prudent.

Rainfall Intensity - given that the intensity of rainfall plays an important role in the movement of particulates, the intensity of rainfall was determined for each of the five reservoirs. The rainfall intensity for each reservoir provides a basis for developing a relationship between the five reservoirs regarding the "proximity to water" boundary distance. Based on the average 24-hour maximum rainfall for various periods reported for each reservoir, the following rainfall intensities were defined. These intensities suggest that San Antonio Reservoir would likely have the shortest proximity to water boundary and Pilarcitos Reservoir the longest.

Reservoir	Rainfall Intensity (inches/24-hour period average maximum)
San Antonio	1.67
Calaveras	1.81
Crystal Springs	2.57
San Andreas	3.16
Pilarcitos	3.71

Time of Concentration - Time of concentration is a technically accurate approach for comparing the relative differences in precipitation and, also, the relative differences in land surface characteristics. Because the movement of particulates is due to overland runoff, the proximity to water classification is actually a function of the overland flow characteristics - characteristics of the land and rainfall event. The most important land surface characteristics are slope, soil type, soil moisture, and roughness of the land. The most important rainfall characteristics are intensity and duration of the rainfall event. Time of concentration incorporates these characteristics to varying degrees. A detailed discussion of this analysis can be found in the Appendix. Below is a summary of the time of concentrations and the corresponding proximity to water boundaries defined for each reservoir. As suggested by the rainfall intensity data and confirmed by the time of concentration analysis, the San Antonio Reservoir has the shortest and Pilarcitos Reservoir the longest proximity to water boundaries.

Reservoir	Duration (Tc) of 1.3 "/hr storm (minutes)	Proximity to Water (feet)
San Antonio	11.5	300
Calaveras	12	380
Crystal Springs	18	600
San Andreas	20	900
Pilarcitos	25	1,300

Given this information, the following classifications were defined for the proximity to water vulnerability zones.

high	0 to 1,300 feet from the high water line of the reservoir (maximum value varies depending upon the reservoir, see above) 0 to 1,300 feet from the centerline of stream (maximum value varies depending upon in which precipitation isoline a particular tributary is located)
medium	a medium classification was not defined for this characteristic because it was not deemed defensible
low	areas outside the 300 to 1,300-foot proximity and within 2,000 feet of SFWD owned lands

- **Wildlife Concentration Areas** - those areas which are identified as having high wildlife concentrations were intended to be targeted as high vulnerability zones because of the disturbance caused to the soils which may increase particle transport. In part, these areas are included in the proximity to water layer because mammals must travel to and from the reservoirs for water. Data were insufficient to allow any further classifications to be made outside the proximity to water layer.

SOCs and Pesticides Vulnerability Zone

The impact of each of the following watershed characteristics on SOC and pesticide vulnerability was defined by the tendency of the characteristic to influence SOC and pesticide transport into the waterbodies as a result of an activity within the watershed. SOCs and pesticides from an activity are assumed to either be present in an aqueous form or adsorbed onto the soil. SOC and pesticide transport, therefore, occurs through either aqueous or particle transport.

- **Soils** - based on the transport mechanisms mentioned above, the impact of soils on SOC and pesticide transport is influenced by the soil's permeability and adsorptive capacity. If a soil has a low permeability then ponding may occur which means aqueous transport is a viable transport mechanism. If a soil has a high adsorption capacity then particle transport becomes the important transport mechanism.

  Adsorption capacity refers to the ability of a particular soil to adsorb a chemical. The cation exchange capacity of each soil was used as an indicator of adsorption capacity.

  In general, soils with low permeability have high adsorption capacity. For example, clays tend to have low permeability and high adsorption capacity, loams medium, and sands/gravel have high permeability and low adsorption capacity. This relationship suggests parallel relationships between the soils' high, medium and low classificiations for both of these characteristics. Therefore, clays would have a high classification, loams a medium classification and sands/gravel a low classification.

  The one exception to this interpretation of the impact of soils on SOCs and pesticides is the consideration pertaining to groundwater. In general, those soils with high permeability would have a high vulnerability because they would allow the SOCs and pesticides to penetrate down to the groundwater aquifer. This is an opposite interpretation of permeability and its impact on surface water. This concern regarding groundwater, however, is included in the definition of the proximity to water layer.

- **Slope** - because both the aqueous and particle transport mechanisms are important for SOC and pesticide transport, slopes which enhance runoff versus particle transport were used as

the criteria for establishing the high, medium, and low classifications. Storm water management design criteria were used to define the ranges summarized below.

high	greater than 30 %
medium	10 to 30 %
low	0 to 10 %

- **Vegetation** - high, medium, and low classifications for vegetation were determined based on the ability of the different vegetation communities to provide a protective layer between rainfall and soil - soils which may contain adsorbed SOCs/pesticides thus reducing particle transport. Given this line of reasoning, forested areas were considered the most protective (low), woodlands, scrubs and chaparral medium (medium), and grasses the least protective (high).
- **Proximity to Water** - the justification for selecting the proximity classification below is summarized under the Particulate Vulnerability Zone section. In addition, a high classification was established for the Sunol Valley aquifer. The ease of transport of SOCs and pesticides through alluvial deposits into the upper aquifer, which is considered "under the influence of surface water", and the potential impact of SOCs and pesticides on downstream users were influential in this decision.

high	0 to 1,300 feet from the high water line of the reservoir (maximum value varies depending upon the reservoir, see above) 0 to 1,300 feet from the centerline of stream (maximum value varies depending upon in which precipitation isoline a particular tributary is located) Sunol Valley - alluvial valley defined as the 360-foot contour, where alluvial soils are present
medium	a medium classification was not defined for this characteristic because it was not deemed defensible
low	areas outside the 300 to 1,300-foot proximity and within 2,000 feet of SFWD owned lands

- **Wildlife Concentration Areas** - those areas which are identified as having high wildlife concentrations were intended to be targeted for consideration in developing the overall SOC/pesticide vulnerability zones. The disturbance caused to soils - which may contain adsorbed SOCs/pesticides - is the key issue and their ultimate transport into the waterbodies. In part, these areas are included in the proximity to water layer because mammals must travel to the reservoirs for water. Data were insufficient to allow any further classifications to be made outside the proximity to water layer.

Microorganisms Vulnerability Zone

The impact of each of the following watershed characteristics on microorganism vulnerability was defined by the tendency of the characteristic to increase microbiological survival and ultimate transport into the waterbodies within each watershed. The microorganisms of concern include total coliforms, *Giardia*, and *Cryptosporidium*. Because of the difficulty in treating *Cryptosporidium*, when compared to total coliforms and *Giardia*, emphasis was placed on this microbe when the vulnerability zones were defined for each watershed characteristic below.

- **Soils** - when considering microorganism survival in a non-waterbody environment, moisture content, nutrients (carbon, nitrogen and phosphorus), and pH were considered important environmental conditions. Of these three, moisture content is considered the most important

for *Cryptosporidium* survival (*Cryptosporidium* is known to survive in moist environments for up to six months without entering a waterbody). Therefore, moisture content defined by available water capacity or water-holding capacity was used as the soil characteristic of interest. Available water capacity or water-holding capacity is defined by the U.S. Natural Resources Conservation Service (NRCS). In general, clay has a high moisture content, loam a medium content, and sand/gravel a low moisture content.

- **Slope** - the two transport mechanisms being considered for this project include aqueous and particle transport. Microorganisms are assumed to fall into the particle transport category. Therefore, the high, medium, and low classifications for the microorganism slope ranges were defined based on increased particle transport.

high	greater than 30 %
medium	15 to 30 %
low	0 to 15 %

- **Vegetation** - high, medium, and low classifications for vegetation were determined based on the ability of the different vegetation communities to provide a protective layer from sunshine, thereby providing for higher moisture conditions to exist which will allow *Cryptosporidium* to survive longer. Given this line of reasoning, forested areas were considered the most protective (high), woodlands, scrubs and chaparral medium (medium), and grasses the least protective (low) from the sun.

- **Proximity to Water** - the justification for selecting the proximity classification below is summarized under the Particulate Vulnerability Zone section.

high	0 to 1,300 feet from the high water line of the reservoir (maximum value varies depending upon the reservoir, see above) 0 to 1,300 feet from the centerline of stream (maximum value varies depending upon in which precipitation isoline a particular tributary is located)
medium	a medium classification was not defined for this characteristic because it was not deemed definsible
low	areas outside the 300 to 1,300-foot proximity and within 2,000 feet of SFWD owned lands

- **Wildlife Concentration Areas** - those areas which are identified as having high wildlife concentrations and which are near the waterbodies will be targeted for consideration in developing the overall microorganism vulnerability zones. It is these areas where high concentrations of mammals, such as cattle and deer, may pass to drink water. It is assumed that these areas are where higher concentrations of waste products can be found which, in turn, reflects the potential for a higher source area for microorganisms. These areas are included in the proximity to water layers.

THM Precursor Vulnerability Zone

The impact of each of the watershed characteristics on THM precursor vulnerability was defined by the tendency of the characteristic to influence THM precursor loading and transport into the waterbodies within each watershed. THM precursors refers to the natural organic carbon which exists in each watershed in the form of decayed vegetation, bark, and animal carcasses as well as animal wastes. THM precursor is the terminology used here to represent the precursor for disinfection by-products (DBPs) in general.

These THM precursors can occur in one of several forms: decaying, decayed, and layered within the soil, decayed and adsorbed onto soil, and/or decayed and existing in water. The dissolved organic carbon concentrations in sheet flows are reduced when the water comes in contact with adsorptive clays, thus reducing the concentration in runoff but increasing the carbon content in clay soils. Therefore, from a land management water quality perspective, particle transport is the mechanism of concern for moving THM precursors into the waterbodies.

- **Soils** - as described above, particle transport mechanisms are of interest. The natural organic content, defined by the natural fertility of soils, was determined based on information provided in soil survey manuals. Given that data pertaining to the organic carbon content of soils in the watersheds are either non-existent or very limited, natural fertility was used as opposed to organic carbon. In general, clay has a high natural fertility, loam a medium natural fertility, and sand/gravel a low natural fertility.

- **Slope** - for this analysis, THM precursors are assumed to fall into the particle transport category. Therefore, the slope ranges were defined based on increased particle transport.

high	greater than 30 %
medium	15 to 30 %
low	0 to 15 %

- **Vegetation** - vegetation was considered from two different perspectives -- its contribution to the organic carbon content through litter decomposition, and its protective capabilities regarding rainfall and erosion. With respect to its organic carbon content, information pertaining to the organic carbon content and ease of decay of the vegetation communities is non-existent. Data, limited as it is, is only available for specific vegetation species and, therefore, could not be incorporated into this analysis. Therefore, the vegetation communities were evaluated according to their ability to protect the ground from intense rainfalls, which in turn decreases the transport of THM precursor material. Following this line of reasoning, forested areas were considered the most protective (low), woodlands, scrubs and chaparral medium (medium), and grasses the least protective (high).

- **Proximity to Water** - the justification for selecting the proximity classification below is summarized under the Particulate Vulnerability Zone section.

high	0 to 1,300 feet from the high water line of the reservoir (maximum value varies depending upon the reservoir, see above) 0 to 1,300 feet from the centerline of stream (maximum value varies depending upon in which precipitation isoline a particular tributary is located)
medium	a medium classification was not defined for this characteristic because it was not deemed definsible
low	areas outside the 300 to 1,300-foot proximity and within 2,000 feet of SFWD owned lands

- **Wildlife Concentration Areas** - those areas which are identified as having high wildlife concentrations were intended to be targeted for consideration in developing the overall THM Precursor vulnerability zones. The disturbance caused to soils - which contain organic carbon - is the key issue and their ultimate transport into the waterbodies. In part, these areas are included in the proximity to water layer because mammals must travel to the reservoirs for water. Data were insufficient to allow any further classifications to be made outside the proximity to water layer.

Nutrient Vulnerability Zone

The impact of each of the watershed characteristics on nutrient vulnerability was defined by the tendency of the characteristic to influence nutrient loading in the watershed and readily transport nutrients into the waterbodies. Nutrients refer to the nitrogen and phosphorus which exists in each watershed. Nutrient sources include vegetation, soils, and animal wastes. The nutrients associated with vegetation matter can only enter the waterbodies if the vegetation releases it during the decaying process. Nutrients, therefore, are associated with decaying vegetation matter and animal wastes, adsorbed onto soils, or leached through runoff. Given these various forms, the nutrients adsorbed onto soils are probably the most abundant which suggests that particle transport is the predominant mechanism for moving them into the waterbodies.

- **Soils** - the nutrient loading for each soil, defined by the natural fertility of each soil, was determined based on information in the soil survey manuals. Given that data pertaining to the nitrogen and phosphorus content of soils in the watersheds is either non-existent or very limited, natural fertility was used as opposed to nutrient loading. In general, clay has a high natural fertility, loam a medium natural fertility, and sand/gravel a low natural fertility.

- **Slope** - since nutrients are present in both dissolved and particulate forms it was conservatively assumed that slopes which increase runoff will determine the high, medium, and low slope classifications.

high	greater than 30 %
medium	10 to 30 %
low	0 to 10 %

- **Vegetation** - vegetation was considered from two different perspectives -- its contribution to the nutrient loading and its protective capabilities regarding rainfall. With respect to its nutrient loading, specific information pertaining to the nutrient loading to soils through litter decomposition or to runoff by leaching versus the cycling of nutrients through vegetation is not available in a format required for this project. Data, limited as it is, is only available for certain specific vegetation species - not communities - and, therefore, could not be incorporated into this analysis. Instead the vegetation communities were evaluated according to their ability to protect the ground from intense rainfalls, which in turn decreases the transport of nutrients. Following this line of reasoning, forested areas were considered the most protective (low), woodlands, scrubs and chaparral medium (medium), and grasses the least protective (high).

- **Proximity to Water** - the justification for selecting the proximity classification below is summarized under the Particulate Vulnerability Zone section.

high	0 to 1,300 feet from the high water line of the reservoir (maximum value varies depending upon the reservoir, see above)
	0 to 1,300 feet from the centerline of stream (maximum value varies depending upon in which precipitation isoline a particular tributary is located)
medium	a medium classification was not defined for this characteristic because it was not deemed definsible
low	areas outside the 300 to 1,300-foot proximity and within 2,000 feet of SFWD owned lands

- **Wildlife Concentration Areas** - those areas which are identified as having high wildlife concentrations and which are near the waterbodies were targeted for consideration in developing the overall nutrient vulnerability zones. It is these areas where high

concentrations of mammals, such as cattle and deer, may pass to drink water. It is assumed that these areas are where higher concentrations of waste products can be found which, in turn, reflects the potential for a higher source area for nutrients, particularly nitrogen. In part, these areas are included in the proximity to water layer because mammals must travel to the reservoirs for water. Data were insufficient to allow any further classifications to be made outside the proximity to water.

WATERSHED CHARACTERISTICS COMPOSITING METHOD - RATIONALE AND VERIFICATION

Table 1 is a summary of the relationships between the five watershed characteristics and the five water quality parameter groups. The rationale for combining the information from each of these five watershed characteristics is discussed below. Five water quality vulnerability zone maps and a composite map are the result of this combination of information, however, the THM Precursor and Nutrient Loading maps are identifical due to the lack of pertinent data at this time.

In order to develop a rationale for the compositing approach, the roles of the five watershed characteristics were defined as summarized below.

Soils	Source/Influence/Transport
Vegetation	Transport/Source
Slope	Transport
Proximity to Water	Transport
Wildlife Concentrations	Influence/Source

"Source" is defined as the watershed characteristic which is an originator of the water quality parameter group being considered (eg. wildlife concentrations are a source of microorganisms). Source, used here, does not include watershed land uses and activities (such as roads) which are sources of a parameter. "Influence" indicates the watershed characteristic which enhances the survival or movement into the waterbodies of the water quality parameter group. "Transport" indicates the watershed characteristic which increases the movement of the water quality parameter group into the waterbodies.

Of these three roles, transport is the most important followed by source and then by influence. In support of this concept is the following rationale: a water quality parameter of concern will never be an issue if it does not reach a waterbody. As a corollary, a water quality parameter which is perceived as a non-issue may become a concern because it reaches the waterbodies. Given the relative importance between the three roles, the following rationale was developed for the composite vulnerability zone maps.

Rationale

Numerical weighting factors were avoided as a tool to be used in the composite approach because of the subjective nature associated with the assignment of the numerical values. It was determined that numerical weighting factors could become a source of criticism and ongoing discussion. Instead, identification of the relative importance of the specific watershed characteristics was used. Also, the high, medium, and low classifications given to the watershed characteristics were used.

Because of its importance to the control (reduction) of the concentration of water quality parameters entering the water bodies, the high vulnerability areas defined for the proximity to water layer will take precedence and, therefore, will be defined as high vulnerability zones on all the composite maps. Since the wildlife concentration area is included in the proximity to water layer, it will not be considered as a separate layer in the composite.

WATER QUALITY PARAMETER GROUPS	WATERSHED CHARACTERISTICS				
	Soils	Vegetation	Slope	Proximity to Water	Wildlife Concentration (includes cattle)
Particulates	Dry Density	Protective Layer	Particulate Transport	Rainfall Intensity	Included in Proximity to Water
SOCs	Adsorption Capacity	Protective Layer	Increased Runoff	Rainfall Intensity plus Alluvial Valley	Included in Proximity to Water
Microorganisms	Moisture Content	Protective Layer	Particulate Transport	Rainfall Intensity	Included In Proximity to Water
THM Precursors	Natural Fertility	Protective Layer	Increased Runoff	Rainfall Intensity	Included In Proximity to Water
Nutrient Loading	Natural Fertility	Protective Layer	Increased Runoff	Rainfall Intensity	Included In Proximity to Water

**RELATIONSHIPS BETWEEN
WATERSHED CHARACTERISTICS AND
WATER QUALITY VULNERABILITY ZONE DEVELOPMENT**

TABLE 1

The remaining three watershed characteristics are soils, vegetation, and slope. For an area to be defined as a "high", slope must be high and either soils or vegetation must be high. For an area to be defined as a "low", two of the three remaining watershed characteristics must be low. All other areas will be defined as medium. In theory this concept makes sense and avoids the pitfalls which may arise out of using numerical weighting factors -- the exact values of which can always be disputed.

Verification

In order to verify this rationale for developing the water quality vulnerability zones, two empirically based evaluation techniques were used. One technique, the Universal Soil Loss Equation (USLE), is a common tool used by the agricultural industry. The second technique, the Erosion Hazard Rating (EHR) System, is a common tool used by the forestry industry. As yet a technique has not been developed for the water quality industry, therefore, both of these techniques were used. While both techniques take into account erosion potential, the agricultural industry technique more closely relates to water quality concerns because it places a higher weighting on the soil types (clays, loams) which are more easily transported and ultimately can become a water quality/treatment problem. The forestry industry technique, on the other hand, places emphasis on soils (sand, gravel) which may erode more easily, but tend to settle out more easily once they enter a water body and ultimately do not necessarily present water quality/treatment problems. Both techniques consider slope to be an important characteristic. However, the ULSE is oriented toward slopes in the ranges considered herein (0 to 30 percent) while the EHR System is oriented toward even higher slopes (40 to 80 percent) which are important for major movements of sediment. Given these points, the agricultural technique was used as the main verification tool with the forestry technique being used as a further verification check.

Universal Soil Loss Equation. The USLE is typically presented as:

$$A = R\,K\,L\,S\,C\,P,$$

where: A is the estimated soil loss,
R is the erosivity of the rainfall,
K is the soil erodibility,
L is a slope length factor,
S is the slope steepness factor,
C is a cover management factor, and
P is a supporting practices factor.

In order to develop a general weighting approach for all five watersheds the following factors are assumed equal or constant between the five reservoirs: R, L, and P factors. The formula is then simplified and is comprised of a relationship between soil loss and the three characteristics of slope, soil type, and vegetation. These characteristics correspond to the three highlighted above: soil, slope, and vegetation.

$$\text{Relative soil loss} = K\,S\,C$$

Given this relationship, for verification purposes, the three composite vulnerability classifications (high, medium, and low) developed from these three watershed characteristics must be evaluated according to accepted values for the three watershed characteristics used in the USLE.

Wischmeier, et.al., in the Journal of Soil and Water Conservation, 1971, developed a nomograph relating USLE K factor to soil type. For sandy soils (low vulnerability), this gives a K ranging between 0.10 and 0.25. For loamy soils (medium vulnerability), the nomograph gives a K value between 0.25 and 0.40. For clay soils (high vulnerability), a K value between 0.40 and 0.60 is

indicated. Average range values were selected for the K factor corresponding to each of the soil types as follows:

Soil Type	Vulnerability	Average K Factor
Sandy soils	Low	0.175
Loamy soils	Medium	0.325
Clay soils	High	0.500

Slope steepness factor, or S, is related to slope by the following equation:

$$S = 65.4\,s^2 + 4.56s + .065$$

where: s is the SINE of the slope angle

The ranges of the slopes identified for particulate transport are as follows: low vulnerability - 0 to 15 percent, medium vulnerability - 15 to 30 percent, and high vulnerability - greater than 30 percent. Average range values were selected for each of the slope ranges and the S factors calculated as follows:

Slope %	Vulnerability	S Factor
7.5	Low	1,230
22.5	Medium	11,100
40	High	36,500

The cover management factor, or C, provides a measure of the extent to which vegetation intercepts and breaks the kinetic energy of the raindrops thus reducing its erosivity, and the extent to which the movement of water along the ground is impeded by ground cover (leaf litter). The vegetation classifications used in the vulnerability zone development correspond roughly to the following values provided by Wischmeier.

General Vegetation Communities	Vegetation Type	Vulnerability	C Factor
Forests	Trees, no brush 75% cover 80% ground cover	Low	0.013
Woodlands Scrubs	Brush or bushes, 50 % cover 20% ground cover	Medium	0.16
Grasses	Grasses, no canopy 20% soil contact	High	0.20

Now that values for K, S, and C have been defined, the USLE calculations can be made for the combinations of high, medium, and low classifications corresponding to the soils, vegetation, and slope combinations defined by the composite rationale defined above. Table 2 contains a summary of the 27 possible combinations, the corresponding USLE calculated values, and the composite ratings based on the rationale defined previously.

The combinations in Table 2 are ranked according to their corresponding USLE values. With the exception of a few combinations, the USLE factors verify the compositing rationale defined

previously. Given the importance of slope in the composite rationale and verified by the USLE, for compositing purposes the three asterisked ratings are changed as indicated in Table 2.

Surface Soil Erosion Hazard Rating. As further verification and a check on the USLE comparison, the California Department of Forestry EHR System was also applied. The Forestry method states that the erosion hazard rating is the sum of a soil factor, a slope factor, a protective cover factor, and a precipitation intensity factor.

Surface Soil Erosion Hazard Rating = Soil + Slope + Vegetation + Rainfall

Average values for each factor within each of the five watersheds were determined and input to this formula and the results compared to the composite rationale ratings in Table 2. Although this technique does not address drinking water quality concerns as closely as the agricultural technique of USLE, the results of the analysis do support the verification of the composite rationale. In addition, they also support the emphasis placed on slope and, therefore, the changes highlighted in Table 2 which were based on slope.

TABLE 2

VERIFICATION OF COMPOSITE RATIONALE BY USLE CALCULATION

COMPOSITE COMBINATIONS OF WATERSHED CHARACTERISTICS			CALCULATED USLE FACTOR USLE = K S C	COMPOSITE RATIONALE RATING(1)
Soils	Vegetation	Slope		
High	High	High	3,647	High
High	Medium	High	2,553	High
Medium	High	High	2,370	High
Medium	Medium	High	1,659	Medium* - High (2)
Low	High	High	1,276	High
High	High	Medium	1,112	Medium
Low	Medium	High	893	Medium
High	Medium	Medium	778	Medium
High	Low	High	729	High
Medium	High	Medium	723	Medium
Medium	Medium	Medium	506	Medium
Medium	Low	High	474	Medium
Low	High	Medium	389	Medium
Low	Medium	Medium	272	Medium
Low	Low	High	255	Low* - Medium
High	Low	Medium	222	Medium
Medium	Low	Medium	145	Medium
High	High	Low	123	Medium
High	Medium	Low	86	Medium
Medium	High	Low	80	Medium
Low	Low	Medium	78	Low* - Medium
Medium	Medium	Low	56	Medium
Low	High	Low	43	Low
Low	Medium	Low	30	Low
High	Low	Low	25	Low
Medium	Low	Low	16	Low
Low	Low	Low	9	Low

(1) Composite Rationale defined previously in Watershed Characteristics Compositing Method Section.

(2) Asterisked composite rationale ratings indicate they were modified based on the verification evaluation.

APPENDIX
PROXIMITY TO WATER VERIFICATION

The classification of watershed lands in terms of how close they are to a water body is based upon the typical distance over which particulates might move. Because the movement of particulates is due to overland runoff, the proximity to water classification is actually a function of the overland flow characteristics of the land surface.

Overland flow may be estimated using a number of different techniques, from a simple rational method approach to sophisticated deterministic rainfall runoff models. In any of these techniques, the important factors driving the overland flow are the characteristics of the land surface and the characteristics of the rainfall event. The most important land surface characteristics are slope, soil type, soil moisture, and roughness of the land. The most important rainfall characteristics are intensity and duration of the rainfall event.

If all of the watershed lands had the same surface characteristics, the overland flow, and hence the movement of particulates, would simply be a function of the intensity of the rainfall and duration of the rainfall event. And, if we assume that a certain rainfall intensity is necessary in order to move particulates, the amount of material moved into the water body is directly related to how long that intensity lasts. For example, if one rainfall event lasts twice as long as another, then material may travel from twice as far away, and thus twice as much material may enter the water body.

A minimum distance of 300 feet from the high water line has been established as defining the limit of the high proximity to water vulnerability zone for the San Antonio Reservoir. Comparable proximity distances were established for the other watersheds, based upon the differences in their relative average 24-hour maximum precipitation as compared to the San Antonio Reservoir.

A more technically accurate approach is to compare the relative differences in precipitation and, also, the relative differences in land surface characteristics. In order to accomplish this comparison, the time of concentration was calculated for each reservoir. The time of concentration (Tc) of a basin is used in this analysis as a measure of how long rainfall must continue until all of a designated area within a basin is contributing runoff. The formula for Tc used in this analysis is defined below. This Tc formula is one of the first, and most widely used, relationships proposed for use with ungauged watersheds, developed by C. E. Ramser (1927).

$$Tc = [2.2\, n\, (Lo) / (So)^{.5}]^{0.467}$$

where: n is the Manning's roughness coefficient
Lo is the overland distance from the point of farthest contribution in meters
So is the average slope

The equation can then be rearranged and solved for Lo as follows.

$$Lo = 10^{[\mathrm{Log}(Tc)/.467 - \mathrm{Log}(2.2\, n / (So)^{0.5})]}$$

The estimated values used for Manning's roughness and slope for each of the watersheds are summarized below. Manning's roughness was varied based upon the identification of the predominant vegetation community (area-wise) which represents each of the five reservoirs. The corresponding values for Manning's roughness were obtained from Hydrologic Modeling of Small Watersheds by Haan, Johnson and Brakensier, ASAE, 1982.

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

Reservoir	Manning's Roughness	Average Slope (percent)
Pilarcitos	0.6	30
San Andreas	0.5	25
Crystal Springs	0.55	20
Calaveras	0.45	30
San Antonio	0.45	25

If we equate the Lo with our proximity to water characteristic on San Antonio Reservoir (Lo = 300 feet), the equation yields a Tc of 11.5 minutes. Precipitation records from the short interval precipitation station nearest San Antonio Reservoir show that the 2-year return interval, 11.5-minute storm has an intensity of 1.3 inches per hour.

Based on an analysis of precipitation records from all over California, James Goodridge (Bulletin No. 195, "Rainfall Analysis for Drainage Design", DWR, 1976) found a strong relationship between the intensity of heavy rainfall, the duration of rainfall, and the mean annual precipitation. By applying this relationship, it is possible to determine the duration of 1.3 inch per hour rainfall on the other watershed areas, corresponding to the two-year return period event at San Antonio Reservoir. A two-year return period was used because it is a common base frequency used for defining precipitation or rainfall events in watersheds.

Based upon the available rainfall records from stations near each reservoir, and modified to reflect reservoir area conditions, as needed, the corresponding rainfall durations, or Tc, having approximately a 1.3 inch per hour intensity, are defined for each reservoir as summarized below.

Reservoir	Duration of 1.3"/hr storm (minutes)
San Antonio	11.5
Calaveras	12
Crystal Springs	18
San Andreas	20
Pilarcitos	25

In turn, using these durations in the time of concentration formula as Tc and the Manning's Roughness coefficients (n) and average slopes (So) defined above for each reservoir, the overland flow distances (Lo), or proximity to water, corresponding to 300 feet at San Antonio Reservoir would be as defined below.

Reservoir	Proximity to Water (feet)
San Antonio	300
Calaveras	380
Crystal Springs	600
San Andreas	900
Pilarcitos	1,300

Appendix C-4

Technical Memorandum #3
Sediment Yields of Alameda and
Peninsula Watersheds
September 1994

San Francisco Water Department

San Francisco Watershed Management Plans

Technical Memorandum No. 3
Prepared for EDAW, Inc.

September 1994

MONTGOMERY WATSON

SYSTECH ENGINEERING, INC.

TECHNICAL MEMORANDUM NO. 3

TO:	Ed Stewart, SFWD Tina Stott, EDAW Karen Johnson, MW	**DATE:**	September 27,1994
		CLIENT:	EDAW, Inc.
PREPARED BY:	Carl W. Chen, Systech Engineering, Inc.	**FILE:**	637.0070
SUBJECT:	Sediment Yields of Alameda and Peninsula Watersheds		

INTRODUCTION

The City and County of San Francisco (City) owns and operates five reservoirs in two local watershed systems--the Alameda Watershed in the eastern San Francisco Bay Area, and the Peninsula Watershed, located to the south of the City on the San Francisco Peninsula.

Two reservoirs comprise the Alameda Watershed--Calaveras and San Antonio. These reservoirs were constructed in 1925 and 1965, respectively. All water withdrawn from these reservoirs is treated at the Sunol Filtration Plant (WTP) prior to entering the distribution system.

The Peninsula Watershed System has three reservoirs--Crystal Springs, Pilarcitos, and San Andreas. Upper Crystal Springs Reservoir was created in 1877. In 1890, Lower Crystal Springs Reservoir was formed by damming San Mateo Creek. A culvert now connects the two water bodies, allowing free exchange between the two reservoirs. Pilarcitos Dam was completed in 1874, while San Andreas was created in 1870. All water from Peninsula reservoirs is treated at the Harry W. Tracy WTP (Tracy WTP) prior to distribution. The Tracy WTP can withdraw watershed water only from San Andreas Reservoir. Water must be transferred from Crystal Springs and Pilarcitos Reservoirs to San Andreas Reservoir for use.

Tributary streams carry sediment. During years of service, the storage capacities of reservoirs diminish because of sediment deposited by local runoff. The purpose of this

memorandum is to document the sediment accumulations in Peninsula and Alameda reservoirs and to discuss the watershed management practices that may reduce the siltation and extend the useful life of the reservoirs.

Abbreviations

Following abbreviations have been used in this memorandum:

ac	acre
af/sq mi/yr	acre-feet per square mile per year
City	City and County of San Francisco
cfs	cubic feet per second
CSD	Crystal Springs Datum
cu ft	cubic feet
DGPS	Differential Global Positioning System
ft	feet
GPS	Global Positioning System
in/yr	inches per year
lb	pound
mg	million gallons
mgal	million gallons
mg/L	milligrams per liter
MSL	mean sea level
PDOP	Positional Dilution of Precision
SFWD	San Francisco Water Department
sq mi	square mile
TM	technical memorandum
T/sq mi/yr	tons per square mile per year
WTP	water treatment plant

METHODOLOGY

In 1994, bathymetric surveys were conducted in each reservoir. From this data, a depth-volume curve was developed. By comparing volumes below a certain depth with historical information, the loss of reservoir capacity to sediment accumulation was estimated.

Bathymetric Survey

The survey was conducted in January of 1994 with a 22 foot (ft) vessel equipped with a Differential Global Positioning System (DGPS) to locate position, and a fathometer to measure water depths. The vessel traveled along parallel tracks spaced at 500 ft intervals. The track lines were oriented perpendicular to the long-axis of each reservoir. During the

bathymetric survey, the position of the vessel was recorded each second. The water depth was logged at 0.1 second intervals.

The DGPS relies on transmissions from the NAVSTAR satellite system to calculate position. The accuracy of the DGPS is a function of the number of satellites from which transmissions can be received at a given time. The recommended positional dilution of precision (PDOP) is a reading of less than four, which occurs when the Global Positioning System (GPS) receives transmissions from five or more satellites. Since the PDOP was less than four during the daylight hours of the survey, the DGPS achieved the desired sub-meter accuracy.

In addition, the U.S. Department of Defense introduces a random error in the transmissions from the NAVSTAR satellite system. In order to obtain accurate readings, it is necessary to set up two receivers--one on the vessel, and one at a stationary location. When the information from the satellite indicates movement of the stationary receiver, a correction factor can be calculated and applied to the boat readings to obtain the actual longitude and latitude. The corrected data, in turn, is input into the navigational computer.

TRIMBLE 4000-SSE was the DGPS used to record the boat position. The system included two GPS receivers (one at a stationary location onshore and one on the boat), an RF telemetry system, and a computer.

On the day of survey, the water level in each reservoir was recorded from staff gages. The fathometer INNERSPACE Model 448 was used to measure water depth. Fathometer calibrations were performed daily at the beginning and end of each survey. A circular metal plate was secured to one end of a sounding line marked with incremental lengths. The plate was lowered to maximum depth, serving as an acoustical target. The fathometer's speed-of-sound control was adjusted until the target reflection matched the depth measured by the sounding line. The target was then raised at five foot intervals to ensure that the adjustment was correct for all depths. This technique yielded an accuracy of +/- 0.1 ft, conforming to the U.S. Army Corps of Engineers' standards for hydrographic surveys. AutoCAD was used to develop bathymetric contours at ten ft intervals. AutoCAD also calculated the cross-sectional area at each ten ft interval. A bathymetric chart was prepared for each reservoir at a scale of one in equals five hundred ft. Plot files (.DWG files) of the charts were also prepared. The datum for charts and plot files was based on mean sea level (MSL).

Historic Depth-Volume Tables

The San Francisco Water Department (SFWD) has an historic depth-volume table for each of the Alameda and Peninsula reservoirs. The watershed keepers read the water elevation in each of the reservoirs on a daily basis. The water depth is converted to storage volumes through the use of the tables. Over the years, this information has been compiled into a time series of reservoir storage volumes.

SFWD references their water levels of all Peninsula and Alameda reservoirs to Crystal Springs datum (CSD). The Crystal Springs datum, inherited from Spring Valley Water Company, is 3.757 ft above the datum of mean sea level used by the U.S. Geological Survey. Therefore, a value of 3.757 ft must be added to all elevations obtained in the bathymetric survey for comparison against historic depth-volume tables. In Calaveras and San Antonio reservoirs, the water elevation is based on Crystal Springs datum. In Pilarcitos, Crystal Springs, San Andreas Reservoirs, the water elevation is based on water depth. The elevations of spillway crest and the gage zero were obtained from SFWD staff in order to convert water depth to elevation based on Crystal Spring datum.

Sediment Accumulation Estimates

Tributary streams have been depositing sediments in the Alameda and Peninsula reservoirs since they were brought into service. To estimate the amount that has accumulated thus far, the difference in reservoir storage capacity was calculated between historic depth-volume tables and the data developed from recent bathymetric surveys. The sediment yield of a watershed was obtained by estimating the annual sediment load per unit of tributary area:

$$\text{Sediment Yield} = \frac{\text{(Maximum Historic Volume - Maximum Recent Volume)}}{\text{(No. of Years Between Bathymetric Studies)*(Tributary Area)}}$$

A specific weight of 60 pounds per cubic foot (lb per cu ft) was assumed for sediments. According to the Interagency Advisory Committee on Water Data (1992), this is a typical value.

CALAVERAS RESERVOIR

Construction on the dam originally started in 1913. A landslide in 1918 destroyed the unfinished work. The reconstruction started in 1921 and was finished in 1925. Thus, the historic depth-capacity curve is assumed to be based on the 1925 bathymetry.

The catchment area is 100 square miles (sq mi). The spillway elevation is 752.46 ft. The gage indication of zero is at elevation 605 ft (CSD). The maximum surface area is 1,435 acres (ac), and the maximum capacity is 31,550 million gallons (mgal).

Depth-Area-Volume Relationships

Figure 1 (all figures are in Appendix) shows the depth-area relationship obtained from data collected in January 1994, and Figure 2 shows the depth-volume relationship. The cross-sectional area varies linearly from zero at elevation 616.8 ft to 47.9 million sq ft at elevation 733.8 ft. The volume increases in a curvilinear relationship from zero mgal at elevation 616.8 ft to 19,220 mgal at elevation 733.8 ft.

Sedimentation

Table 1 presents the change of storage capacity over 69 years. In the intervening years, the lower depths of the reservoir--from elevation 609 ft to 617 ft--have filled with sediment. At elevation 623.8 ft, only 17 percent of the original storage capacity was available. The proportion of remaining storage capacity increased with elevation, as shown in Figure 3. At elevation 733.8 ft, the remained capacity was 87 percent. The storage capacity available at the maximum elevation 752 ft was estimated to be 88 percent.

In the past 69 years, sediment has filled approximately 12 percent of the maximum storage capacity. This amounts to approximately 3,800 mgal, 510 million cu ft, or 12,000 ac-ft. The average watershed yield or sediment accumulation rate was 1.7 acre feet per square mile per year (af/sq mi/yr), or 2,200 tons per square mile per year (T/sq mi/yr).

TABLE 1

CALAVERAS RESERVOIR CHANGE IN STORAGE CAPACITY

1925 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1925 Volume (mgal)	Remaining Capacity (percent)
609.0	0	0.180	0
613.0	0	45.810	0
616.8	0	116.222	0
623.8	51.75	306.654	17
633.8	297.0	732.454	40
643.8	762.1	1,390.450	55
653.8	1,446.0	2,315.519	62
663.8	2,404.0	3,529.610	60
673.8	3,726.0	5,116.946	73
683.8	5,441.0	7,077.207	77
693.8	7,530.0	9,328.648	81
703.8	9,960.0	11,988.259	83
713.8	12,720.0	14,989.754	85
723.8	15,800.0	18,336.365	86
733.8	19,220.0	21,985.705	87

Sources: SFWD historic documents; Systech, Inc., 1994

SAN ANTONIO RESERVOIR

San Antonio Reservoir was completed in 1965. The spillway is at elevation 468 ft (CSD), and the zero of the staff gage is at elevation 323 ft. The area of the catchment measures 39.7 sq mi. The surface area at elevation 468 ft is 1.29 sq mi, or 826 ac. The maximum storage capacity in the reservoir is 16,454 mgal.

Depth-Area-Volume Relationships

Figure 4 shows the depth-area relationship developed from data collected in January 1994. The area varies linearly from 1.8 million sq ft at elevation 343.8 ft to 27.2 million sq ft at elevation 443.8 ft. Below elevation 343.8 ft, the surface area decreases with depth more sharply. Figure 5 shows the depth-volume relationship measured in 1994. The volume

increases in a curvilinear relationship from zero at elevation 318.8 ft to 10,410 mgal at elevation 443.8 ft.

Sedimentation

Table 2 presents the change of storage capacity over 29 years. The depth-volume table from 1965 did not list storage capacities below elevation 370. In 1994, the remaining storage capacity at elevation 373.8 was only 67 percent of the capacity in 1965. The proportion of remaining storage capacity increased with elevation, as shown in Figure 6. At elevation 443.8 ft, the remaining capacity was 98 percent, and when full, 98.5 percent of San Antonio's storage is available.

The sediment that has accumulated since 1965 accounts for 1.5 percent of maximum storage capacity. This is approximately 250 mgal, 33 million cu ft, or 760 ac-ft, or 1 million tons. The watershed yield or sediment accumulation rate averaged 0.66 af/sq mi/yr, or 860 T/sq mi/yr.

TABLE 2

SAN ANTONIO RESERVOIR CHANGE IN STORAGE CAPACITY

1965 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1965 Volume (mgal)	Remaining Capacity (percent)
373.8	1,264	874	67
383.8	1,964	2,575	76
393.8	2,873	3,463	83
403.8	3,984	4,490	89
413.8	5,278	5,745	92
423.8	6,766	7,146	95
433.8	8,476	8,710	97
443.8	10,410	10,609	98

Sources: SFWD historic documents; Systech, Inc., 1994

UPPER CRYSTAL SPRINGS

Although there is free exchange between Upper and Lower Crystal Springs Reservoirs, for the purposes of this analysis, the two reservoirs were evaluated independently. The spillway from Upper Crystal Springs to Lower Crystal Springs is at elevation 263.8 ft (CSD). The catchment area for the upper reservoir is 13.5 sq mi, and the maximum storage capacity is 5,200 mgal. The zero of the gage for Upper Crystal Springs is at elevation 208 ft (CSD). The Upper Dam separating the two Crystal Springs Reservoirs was built in 1877 and raised in 1891. The historic depth-capacity curve is assumed applicable to the 1891 bathymetry.

Depth-Area-Volume Relationships

Figure 7 shows the depth-area relationship measured in January 1994. The area varies almost linearly from zero at elevation 217.8 ft to 17.87 million sq ft at elevation 263.8 ft. Figure 8 shows the depth-volume relationship measured in 1994. The volume increases in a curvilinear relationship from zero at elevation 217.8 ft to 3,341 mgal at elevation 263.8 ft.

Sedimentation

Table 3 presents the change in storage capacity from 1891 until 1994--103 years. The recent field work indicated that sediment filled up the lower depths of the reservoir to elevation 217.8 ft. Only twenty percent of the storage capacity remained at elevation 223.8 ft. Figure 9 shows that the proportion of remaining storage capacity increased with elevation. At elevation 263.8 ft, 71 percent of the capacity remained. The storage capacity at the maximum elevation 280 ft was extrapolated to be 76 percent.

The accumulated sediment volume was 24 percent of the maximum storage capacity of 5,200 mgal. This amounts to approximately 1,250 mgal, or 3,800 ac-ft. From these numbers, the average watershed yield or sediment accumulation rate was estimated to be 2.7 af/sq mi/yr.

TABLE 3

UPPER CRYSTAL SPRINGS RESERVOIR CHANGE IN STORAGE CAPACITY

1891 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1891 Volume (mgal)	Remaining Capacity (percent)
217.8	0		
223.8	98	496	20
233.8	515	1,204	43
243.8	1,180	2,109	56
253.8	2,132	3,260	65
263.8	3,341	4,698	71

Sources: SFWD historic documents; Systech, Inc., 1994

LOWER CRYSTAL SPRINGS

The catchment area for Lower Crystal Springs Reservoir is 9.0 sq mi, and when full the maximum storage capacity is 13,800 mgal. The dam for Lower Crystal Springs Reservoir was built in 1888 and raised in 1890. For the purpose of this analysis, the depth-capacity curve was assumed to be applicable to the bathymetry in 1890. The spillway is at elevation 280 ft, and the gage zero is at elevation 166 ft.

Depth-Area-Volume Relationships

Figure 10 shows the depth-area relationship measured in January 1994. The area varies almost linearly from zero at elevation 166.8 ft to 17.84 million sq ft at elevation 253.8 ft. Figure 11 shows the depth-volume relationship measured in 1994. The volume increases in a curvilinear relationship from zero at elevation 166.8 ft to 6,736 mgal at elevation 253.8 ft.

Sedimentation

Table 4 presents the change in storage capacity from 1890 to 1994. Sediment filled the reservoir below elevation 166.8 ft. At elevation 183.8, the remaining storage capacity was 58 percent. The proportion of remaining storage capacity increased with elevation as shown in Figure 12. At elevation 253.8 ft, the remaining capacity was 84 percent. By extrapolation, the storage capacity at the maximum elevation 280 ft was 86 percent.

The accumulated sediment volume was estimated to be approximately 14 percent of maximum storage capacity of 13,800 mgal. This amounts to approximately 1,930 mgal, or 5,900 ac ft. The average watershed yield or sediment accumulation rate was 6.4 af/sq mi/yr.

TABLE 4

LOWER CRYSTAL SPRINGS RESERVOIR CHANGE IN STORAGE CAPACITY

1890 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1890 Volume (mgal)	Remaining Capacity (percent)
166.8	0		0
183.8	195	333	58
193.8	481	710	68
203.8	14	1,343	68
213.8	1,496	2,180	69
223.8	2,242	3,054	73
233.8	3,157	3,988	79
243.8	4,236	5,185	82
253.8	5,486	6,565	84

Sources: SFWD historic documents; Systech, Inc., 1994

CRYSTAL SPRINGS WATERSHED

Since the two Crystal Springs Reservoirs are interconnected, looking at the sediment yield from the combined catchment areas may be appropriate. The two reservoirs drain a total of 22.5 sq mi. The combined maximum surface area is 1,492 ac, and the maximum capacity for both reservoirs is 19,022 mgal at elevation 280 ft.

Figure 13 presents the depth-volume relationship of the combined Crystal Springs Reservoirs. The remaining capacity in 1994 is shown in Table 5. Figure 14 plots the 1994 storage capacity as a function of elevations. In 1994, 77 percent of the storage capacity remained at elevation 253.8 ft. The capacity remaining at elevation 280 ft was projected to be 80 percent.

Sediment occupied approximately 20 percent of the combined reservoirs' capacities, which amounted to 3,800 mgal, or 12,000 ac-ft. The sediment yield for the entire Crystal Springs Watershed was 5 af/sq mi/yr.

TABLE 5

UPPER AND LOWER CRYSTAL SPRINGS RESERVOIRS CHANGE IN STORAGE CAPACITY

1890 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1890 Volume (mgal)	Remaining Capacity (percent)
166.8	0	0	
173.8	35	64	9
183.8	194	333	58
193.8	481	710	68
203.8	914	1,343	68
213.8	1,496	2,373	63
223.8	2,341	3,498	67
233.8	3,672	5,202	70
243.8	5,415	7,304	74
253.8	7,618	9,835	77

Sources: SFWD historic documents; Systech, Inc., 1994

SAN ANDREAS RESERVOIR

Construction of San Andreas Dam occurred between 1868 and 1870. The dam was raised in 1875, and again in 1928. For the purpose of this analysis, the historic depth-capacity curve is assumed applicable to the bathymetry existing in 1928. The spillway is at elevation 446 ft, and the gage zero is at elevation 360 ft. When the reservoir is full to maximum capacity--elevation 446 ft--the storage measures 6,190 mgal. The catchment area contributing to the reservoir is 4.4 sq mi.

Depth-Area-Volume Relationships

Figure 15 shows the depth-area relationship measured in January, 1994. The area varies almost linearly from zero at elevation 373.8 ft to 13.5 million sq ft at elevation 423.8 ft. Figure 16 shows the depth-volume relationship, also measured in 1994. The volume increases in a curvilinear relationship from zero at elevation 373.8 ft to 297 mgal at elevation 423.8 ft.

Sedimentation

Table 6 presents the change in storage capacity from 1928 through 1994. Below elevation 373.8 ft, the reservoir was filled with silt. At elevation 383.8, 43 percent of the storage capacity remained. The proportion of remaining storage capacity increased with elevation, as shown in Figure 17. At elevation 423.8 ft, the remaining capacity was 73 percent. The storage capacity at the maximum elevation of 446 ft was extrapolated to be 80 percent.

The accumulated sediment volume was estimated at twenty percent of the maximum storage capacity of 6,190 mgal. This is approximately 1,240 mgal, or 3,800 ac-ft. The average sediment accumulation rate was 13.3 af/sq mi/yr. This is a moderate to high value. Because San Andreas receives transfers from the other Peninsula reservoirs, Hetch Hetchy, and Alameda supplies, the elevated sedimentation rate may reflect more than the immediate catchment area.

TABLE 6

SAN ANDREAS RESERVOIR CHANGE IN STORAGE CAPACITY

1928 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1928 Volume (mgal)	Remaining Capacity (percent)
373.8	0		0
383.8	56	31	43
393.8	265	534	50
403.8	683	1,126	61
413.8	1,333	1,976	67
423.8	2,223	3,060	73

Sources: SFWD historic documents; Systech, Inc., 1994

PILARCITOS RESERVOIR

Pilarcitos Dam was built between 1864 to 1866, and raised in 1874. The spillway was reconstructed in 1937. For the purpose of this analysis, the historic depth-capacity curve is assumed to be applicable to the bathymetry which existed in 1937. According to staff sources, the reservoir was dredged in 1977, however there are no records of the quantities of excavated sediment.

The catchment area measures 3.8 sq mi. The spillway is at elevation 683 ft, but flashboards can be inserted to raise the spillway elevation to 694.75 ft. The maximum capacity of the reservoir is 1,010 mgal at elevation 694.75 ft. The zero of the gage is at elevation 650.75 ft.

Depth-Area-Volume Relationships

Figure 18 shows the depth-area relationship measured in January 1994. The area varies almost linearly from zero at elevation 621.8 ft to 3.5 million sq ft at elevation 693.8 ft. Figure 19 presents the depth-volume relationship, also measured in 1994. The volume increases in a curvilinear relationship from zero at elevation 621.8 ft to 821 mgal at elevation 693.8 ft.

Sedimentation

Table 7 presents the change in storage capacity between 1937 and 1994. By 1994, sediment had filled the bottom of the reservoir to elevation 621.8 ft. The storage capacity remaining at elevation 663.8 was 113 percent. The increase in storage volume is likely to have taken place in 1977. Apparently the dredging activities excavated deeper than the contours which existed in 1937. Because of the dredging, the remaining storage capacity decreased with elevation as shown in Figure 20. At elevation 693.8 ft, the remaining capacity was 82 percent. At the maximum elevation of 694.75 ft, the remaining storage capacity was projected to be 80 percent. The accumulated sediment volume filled approximately 20 percent of maximum storage capacity of 1,010 mgal. This amounts to 200 mgal, or 620 ac-ft.

Without the information about the volume of sediment dredged in 1977, it is not possible to calculate the sediment yield for the Pilarcitos Watershed. It is important to recognize that, despite the dredging in 1977, sedimentation over the intervening sixteen years has filled twenty percent of the 1937 reservoir capacity. The watershed yield or sediment accumulation rate, therefore, exceeds 2.9 af/sq mi/yr.

TABLE 7

PILARCITOS RESERVOIR CHANGE IN STORAGE CAPACITY

1937 to 1994

Elevation CSD (feet)	1994 Volume (mgal)	1937 Volume (mgal)	Remaining Capacity (percent)
621.8	0		0
663.8	229	02	113
673.8	381	411	93
683.8	579	676	86
693.8	821	1,001	82

Sources: SFWD historic documents; Systech, Inc., 1994

DISCUSSION

From November to March, wet weather runoff transports sediment, resulting in increased turbidity in the water column during the rainy season. Turbidity starts to decrease at the reservoir surface and increase at the lower depths in late spring. Gradually, the sediment settles at the bottom of the reservoir.

San Antonio Reservoir accepts water transfers from the State Water Project, Hetch Hetchy, and can accept transfers from Calaveras Reservoir; it receives local runoff as well. As a result, turbulence appears to have caused a redistribution of sediment which already existed in the reservoir. The sediment near the surface has been scoured and redeposited at depth. Thus, the reservoir capacity below elevation 373.8 ft was reduced by 32 percent and yet the reservoir capacity below elevation 443.8 ft was reduced only by 2 percent.

In general, the proportion of reservoir capacity remaining in 1994 increased with elevation. The exception is Pilarcitos Reservoir. Due to previous dredging in Pilarcitos, the reservoir bottom was reshaped. The amount of sediment excavated below elevation 663.8 ft significantly increased the storage capacity below that depth. After sixteen years of sedimentation, the storage capacity was still 113 percent of the original. The proportion of remaining capacity in 1994 was inversely correlated with elevation to 82 percent at 693.8 ft, as presented in Figure 20.

Table 8 is a summary table, comparing the sediment accumulation rates for the five reservoirs comprising the Alameda and Peninsula Watersheds. Average annual rainfall is provided to give a general idea about the amount of precipitation falling on each local watershed. In addition, the table lists the precipitation for a 100-year storm event. It is during these large storms that significant sediment transport occurs.

Among these reservoirs, San Antonio watershed has the lowest sediment yield of 0.66 af/sq mi/yr. Upper Crystal Springs watershed has a sediment yield of 2.7 af/sq mi/yr. Since some of the sediment may be transported to Lower Crystal Springs or San Andreas, the sediment yield of Upper Crystal Springs watershed could actually be higher than 2.7 af/sq mi/yr. It could potentially be as high as the sum of the 3 sediment yields (i.e. 2.7, 2.5, and 1.9 af/sq mi/yr) or 7.1 af/sq mi/yr.

TABLE 8

ALAMEDA AND PENINSULA RESERVOIRS WATERSHED SEDIMENT YIELDS

Reservoir	Sediment Yield (af/sq mi/yr)	Sediment Yield (T/sq mi/yr)	Tributary Area (sq mi)	Average Annual Rainfall (in/yr)	100-Year Storm Event (in/yr)
Calaveras	1.7	2,200	100	21.9	41.8
San Antonio	0.66	860	39.7	19.8	40.3
Upper Crystal	2.7	3,500	13.5	29.6	56.6
Lower Crystal	6.3	8,200	9.0	27.0	51.6
San Andreas	13.1	17,100	4.4	34.8	66.4
Pilarcitos	>2.9	>3,800	3.8	43.2	82.5

Sources: SFWD, 1994; Systech, Inc., 1994

In 1973 and again in 1992, the Interagency Advisory Committee on Water Data compiled and published summary data on sediment deposition in United States reservoirs. For California reservoirs, the sediment yields varied from a very low value of 0.1, a low value of 2, a moderate value of 5, a high value of 16, and a very high value of 28, all in af/sq mi/yr.

The comparison indicates that the sediment yield of the San Antonio watershed is very low, and that of the Calaveras watershed is moderately low. The sediment yield from Upper Crystal Springs may range from a low to moderately high value, depending on what proportion of sediment from the watershed is actually transported to Lower Crystal Springs or San Andreas. The sediment yield from the Lower Crystal Springs watershed is moderate to high, once again depending on the amount of sediment transported into San Andreas. San Andreas watershed has a high sediment yield, which may actually be lower depending on the sediments contributed from lands external to the watershed. The sediment yield of the Pilarcitos watershed is likely to be moderate.

During very wet years (those with a return frequency of at least 100 years) the higher annual rainfall results in increased sediment deposition. Site visits indicate evidence of surface and bank erosion in Calaveras and Upper Crystal Springs watersheds. The Pilarcitos watershed had little evidence of erosion; however, the high precipitation rate may

have resulted in the transport of large volumes of sediment to the reservoir. Consequently, we expect the sediment yield of the Pilarcitos watershed to be in the range of 2.9 to 5 af/sq mi/yr.

CONCLUSIONS

Based on the 1994 bathymetric survey, the following conclusions can be made:

1. Sedimentation has reduced the reservoir storage capacity of Peninsula and Alameda reservoirs. In 1994, the proportion of available water storage capacity was as follows:

Reservoir	**Remaining Capacity (percent)**
Calaveras	88
San Antonio	98
Upper Crystal Springs	76
Lower Crystal Springs	86
San Andreas	80
Pilarcitos	82

2. Sediment yield generally increases in watersheds with higher rainfall, and those with more disturbance, which cause surface and bank erosion.

Watershed	**Sediment Yield (af/sq mi/yr)**
Calaveras	1.7
San Antonio	0.66
Upper Crystal Springs	2.7, as high as 7.1
Lower Crystal Springs	6.4, as low as 2.4
San Andreas	13.3, as low as 1.9
Pilarcitos	2.9, as high as 5.0

3. Compared to other reservoirs in California, the Alameda and Peninsula Reservoirs had the following sediment yields.

Watershed	Sediment Yield
Calaveras	low
San Antonio	very low
Upper Crystal Springs	low to moderate
Lower Crystal Springs	low to moderate
San Andreas	low to high
Pilarcitos	low to moderate

Further investigation is needed in the Peninsula watersheds because of the potentially high sediment yields.

RECOMMENDATIONS

Based on the sediment yield analysis described above, the following recommendations are made.

- San Francisco Water Department should exercise good watershed management practices to minimize the sediment yields from the watersheds. This will prolong the useful life of the reservoirs. Best management practices should be required and implemented for all activities within the watersheds which may result in sedimentation.

- A site-specific sediment yield analysis should be performed for any projects that might disturb the watershed and increase sediment transport to the reservoir.

- Bathymetric surveys should be conducted every five years. In the next survey, the water level should be as high as possible so that a more complete bathymetric map can be prepared.

- Further investigation is warranted in the Peninsula watersheds to verify and further understand the sediment accumulation rates and specific sources. The sensitivity of the watersheds to erosion may be due to soil characteristics, slope, vegetation

communities, etc. The tributary streams should be monitored so that flow rates and sediment characteristics and loads can be determined.

APPENDIX

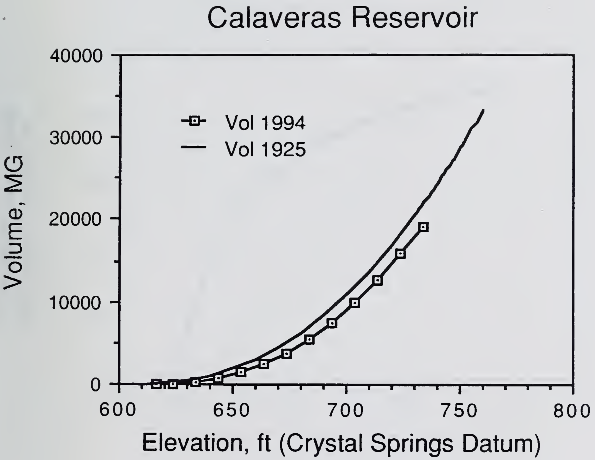


Figure 2

Depth-Volume Relationships of
Calaveras Reservoir for 1925 and 1994

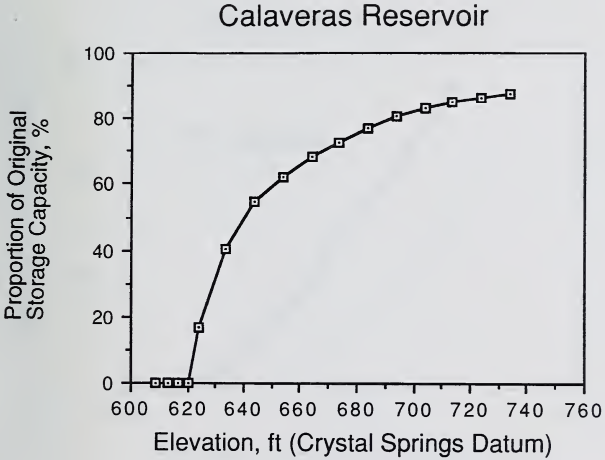


Figure 3

Percent of Original Storage
Capacity Remaining in 1994
Calaveras Reservoir

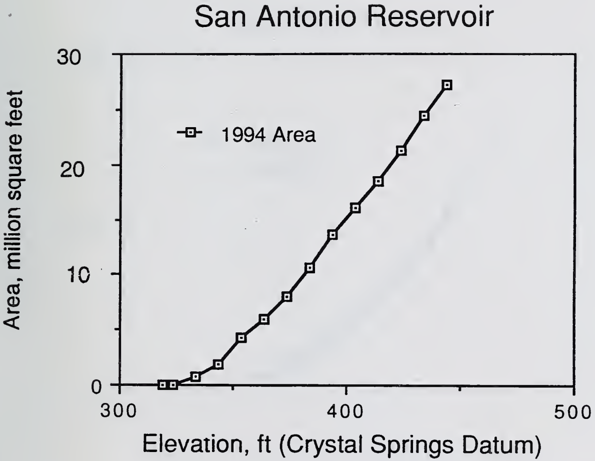


Figure 4

Depth-Area Relationship
of San Antonio Reservoir

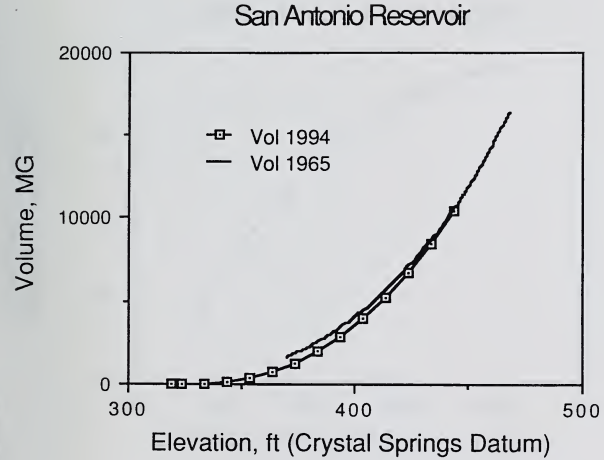


Figure 5

Depth-Volume Relationships of
San Antonio Reservoir for 1965 and 1994

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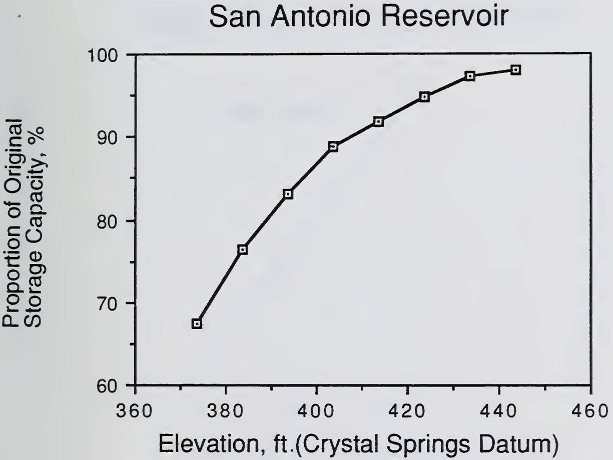

Figure 6

Percent of Original Storage
Capacity Remaining in 1994
San Antonio Reservoir

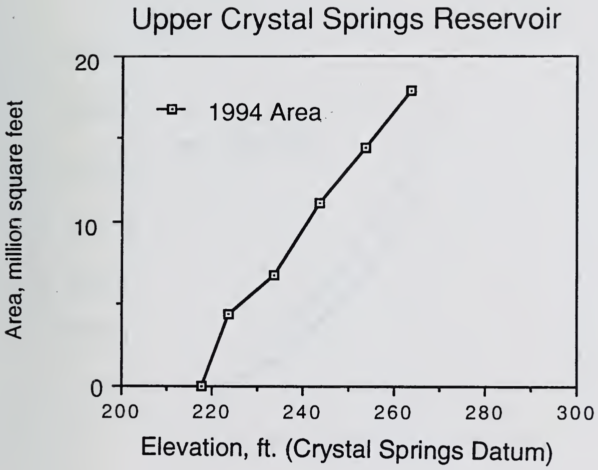

Figure 7

Depth-Area Relationship of
Upper Crystal Springs Reservoir

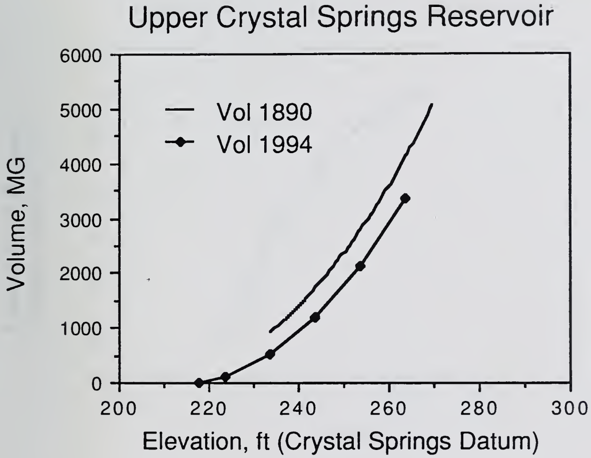

Figure 8

Depth-Volume Relationships of Upper Crystal Springs Reservoir for 1890 and 1994

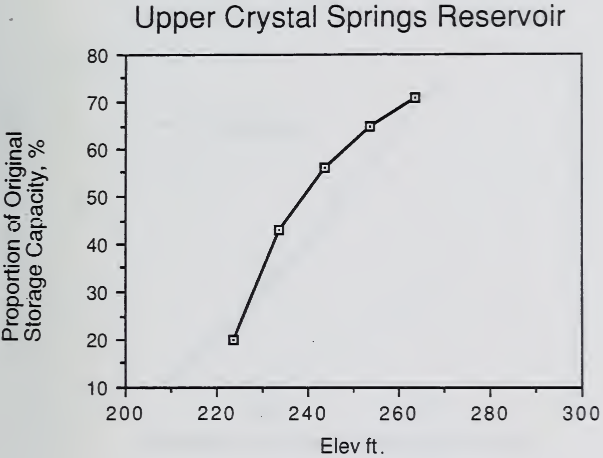

Figure 9

Percent of Original Storage
Capacity Remaining in 1994
Upper Crystal Springs Reservoir

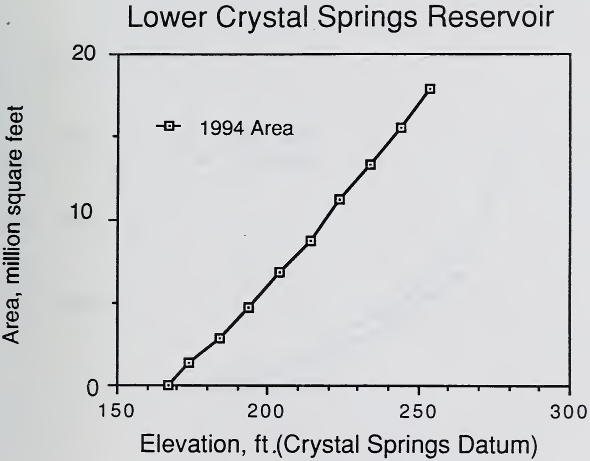

Figure 10

Depth-Area Relationship of
Lower Crystal Springs Reservoir

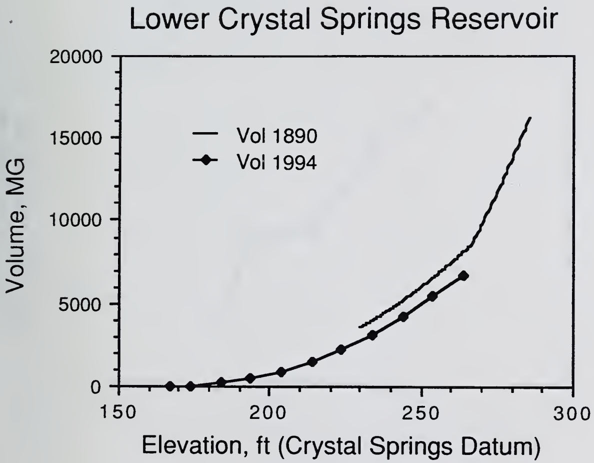

Figure 11

Depth-Volume Relationships of
Lower Crystal Springs Reservoir
for 1890 and 1994

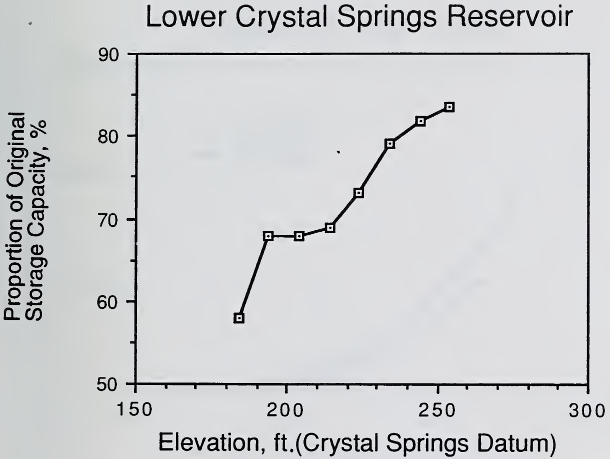

Figure 12

Percent of Original Capacity
Remaining in 1994
Lower Crystal Springs Reservoir

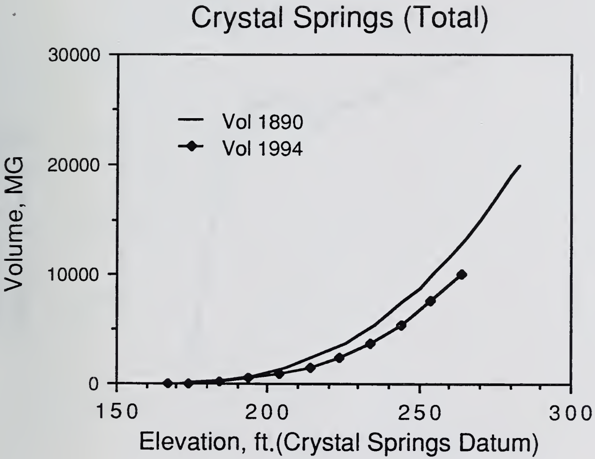

Figure 13

Depth-Volume Relationships of
Crystal Springs Reservoir
for 1890 and 1994

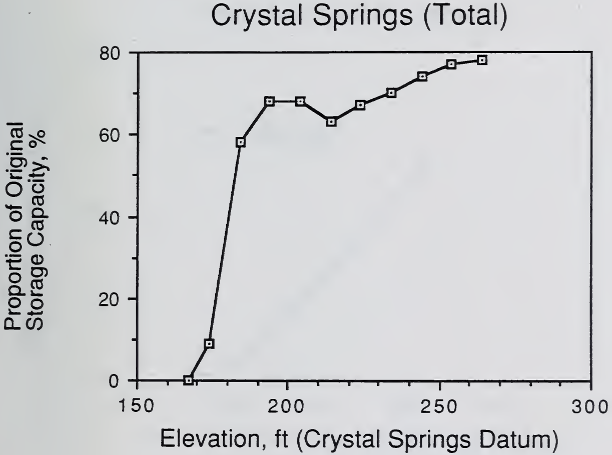

Figure 14

Percent of Original Storage
Capacity Remaining in 1994
Crystal Springs (Total)

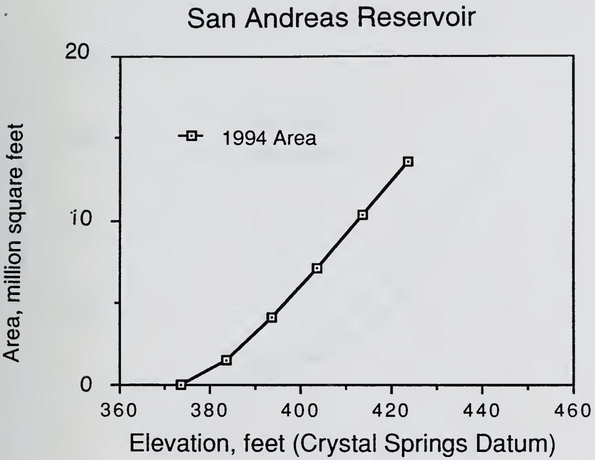

Figure 15

Depth-Area Relationship of
San Andreas Reservoir

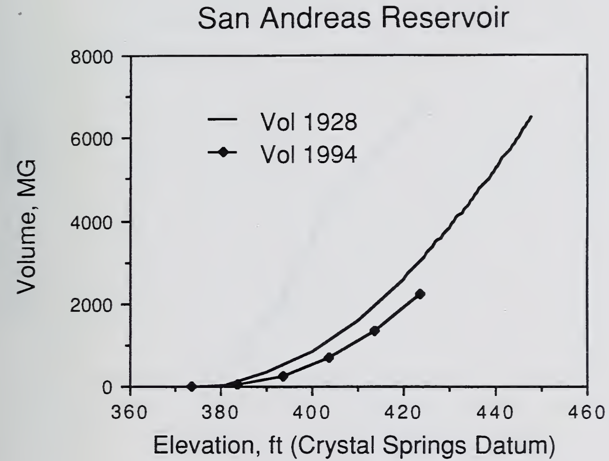

Figure 16

Depth-Volume Relationships of
San Andreas Reservoir
for 1928 and 1994

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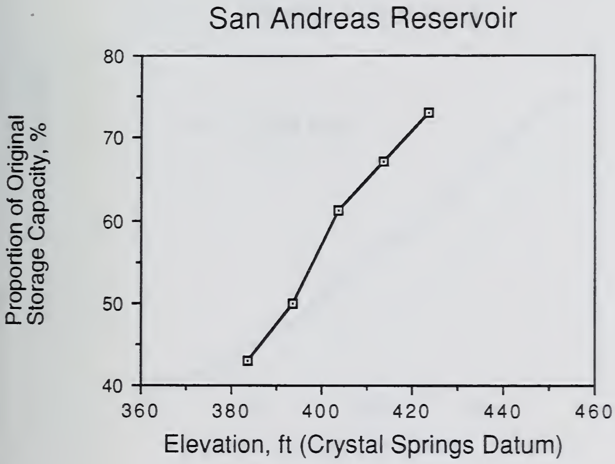

Figure 17

Percent of Original Capacity
Remaining in 1994
San Andreas Reservoir

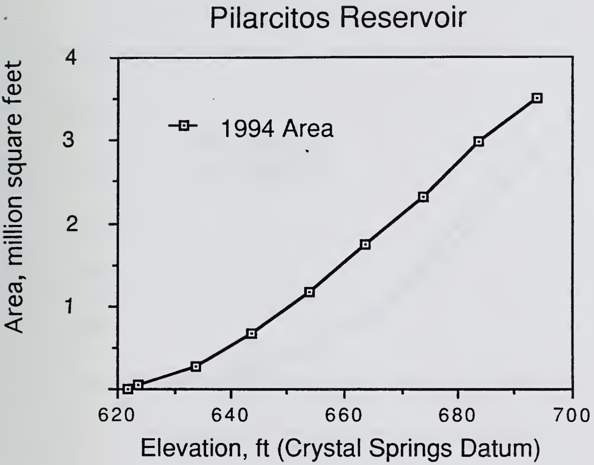

Figure 18

Depth-Area Relationship of
Pilarcitos Reservoir

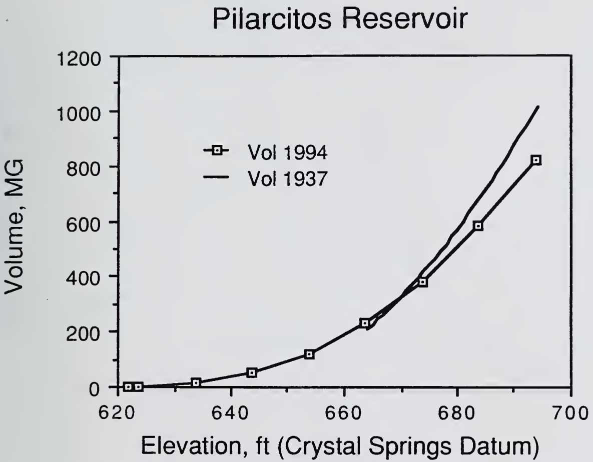

Figure 19

Depth-Volume Relationships of
Pilarcitos Reservoir
for 1937 and 1994

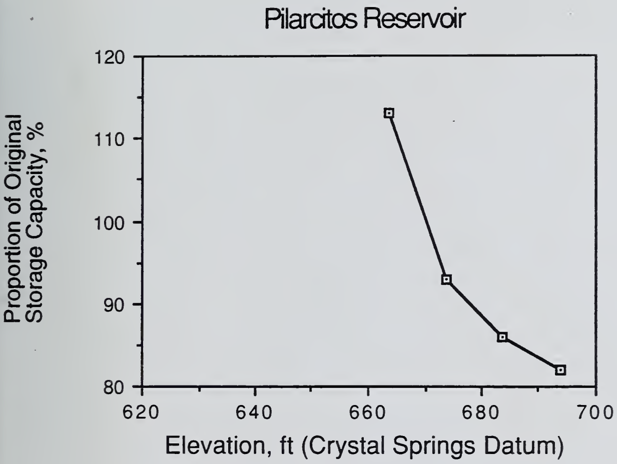

Figure 20

Percent of Original Storage
Capacity Remaining in 1994
Pilarcitos Reservoir

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Appendix C-5

Technical Memorandum #4
Visual Resources
November 1996

SAN FRANCISCO WATERSHED MANAGEMENT PLANS

VISUAL RESOURCES TECHNICAL MEMORANDUM

1.0 ALAMEDA WATERSHED

1.1 Introduction/Regional Setting

The Alameda Watershed lands managed by the San Francisco Water Department (SFWD) encompass 40,000 acres of rolling grassland and native oak woodland in northern Santa Clara County and southern Alameda County. These lands are generally located south of Alameda Creek (Niles Canyon) and east of the western most ridgeline of the Fremont Hills. The SFWD Alameda Watershed lands encompass portions of the Calaveras Reservoir and San Antonio Reservoir hydrologic watersheds. For the most part, watershed lands are relatively remote and not accessible to or viewed by the general public; however, several major roads such as Interstate 680 (I-680) and State Route 84 (SR 84) provide viewing opportunities for a limited portion of the Alameda Watershed lands.

In contrast to SFWD lands on the San Francisco Peninsula, which are essentially undeveloped, a portion of the Alameda Watershed lands are leased for a variety of uses including cattle grazing, plant nurseries, and sand and gravel quarries. These leased lands include areas along I-680 in Alameda County and along SR 84 between the City of Fremont and the community of Sunol. The leased lands and adjacent private lands along I-680 from San Antonio Creek (Sunol Valley) north to Pleasanton are in various stages of development. However, the Alameda Watershed lands consist primarily of undeveloped grassland hills and scattered oak woodlands.

Particular features of interest include views of Calaveras Reservoir, the Sunol Water Temple, and the narrow, forested Niles Canyon. The community of Sunol, which includes a small commercial hub, is located at the junction of Niles Canyon Road and Foothill Road at the north-western edge of the Alameda Watershed lands. A separate parcel of SFWD land is located north of Sunol, following the Arroyo de la Laguna on the west side of I-680. Residential development is located adjacent to this parcel, and a portion of these SFWD lands are leased to the Castlewood Country Club for use as a golf course.

1.2 Key Observation Points

Key observation points have been identified based on federal, state, and county plans. Roads were identified as key observation points based on current or proposed designation in appropriate state or county plans as scenic routes. Other use areas were identified based on their importance, use volume, use duration, and size. These areas typically include designated vista points, trails, parks, and secondary roads to and from regional parks. The following viewpoints (shown in Photos 1-1 through 1-11) form the basis for the discussion of the existing visual conditions of the

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2.2 Key Observation Points 15

2.3 Existing Visual Conditions 24

2.4 Visual Resource Policies and Guidelines 28

2.5 Visual Resource Management Issues/Objectives 29

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This memorandum was prepared during the course of the watershed management plan process. The information presented represents information gathered at a specific point in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some of the items may have been further refined. These refinements are reflected in the Watershed Management Plans.

SAN FRANCISCO WATERSHED MANAGEMENT PLANS

VISUAL RESOURCES TECHNICAL MEMORANDUM

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Particular features of interest include views of Calaveras Reservoir, the Sunol Water Temple, and the narrow, forested Niles Canyon. The community of Sunol, which includes a small commercial hub, is located at the junction of Niles Canyon Road and Foothill Road at the north-western edge of the Alameda Watershed lands. A separate parcel of SFWD land is located north of Sunol, following the Arroyo de la Laguna on the west side of I-680. Residential development is located adjacent to this parcel, and a portion of these SFWD lands are leased to the Castlewood Country Club for use as a golf course.

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Alameda Watershed. A regional map of the Watershed indicating the locations of these viewpoints is shown in Figure 1-1.

- Interstate 680
- Niles Canyon Road
- Calaveras Road
- Vallecitos Road
- Geary Road
- Foothill Road
- Sunol Water Temple

Photo 1-1 View south from I-680 summit

Photo 1-2 View east from I-680 Summit

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[illegible]

Photo 1-3 View east from Niles Canyon Road at Niles Canyon Quarry

Photo 1-4 View south from Calaveras Road near Welch Creek

Photo 1-5 View south from Calaveras Road (Calaveras Reservoir including Calaveras Valley, test site, and transmission line)

Photo 1-6 View north from Calaveras Road (Calaveras Reservoir including dam and waterway intake)

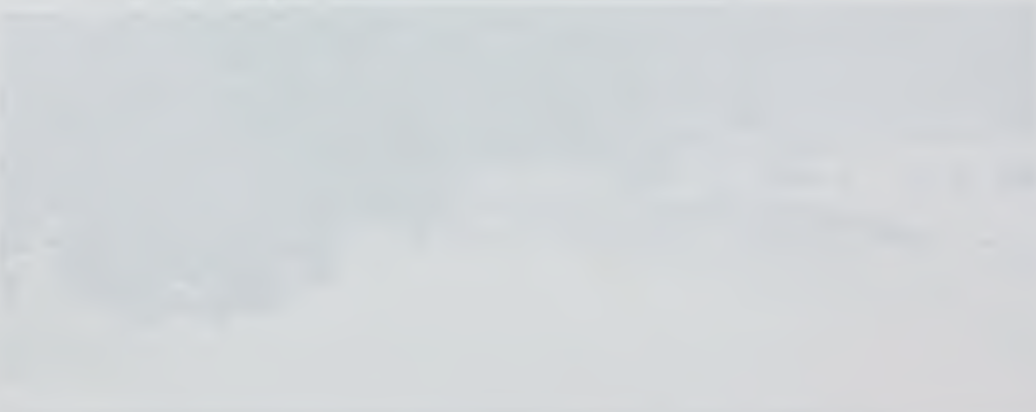


Photo 1-7 View west from Calaveras Road (Transmission line ROW)

Photo 1-8 View south/southeast from Vallecitos Road

Photo 1-9 View east from Vallecitos Road

Photo 1-10 View of Sunol Water Temple

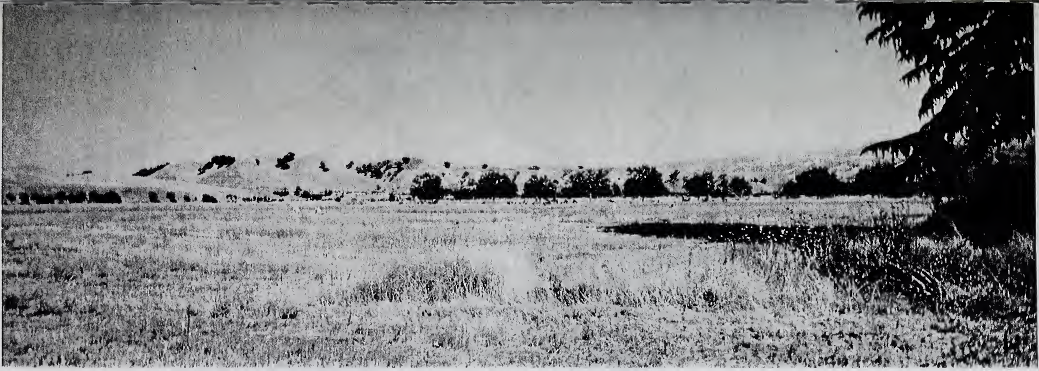
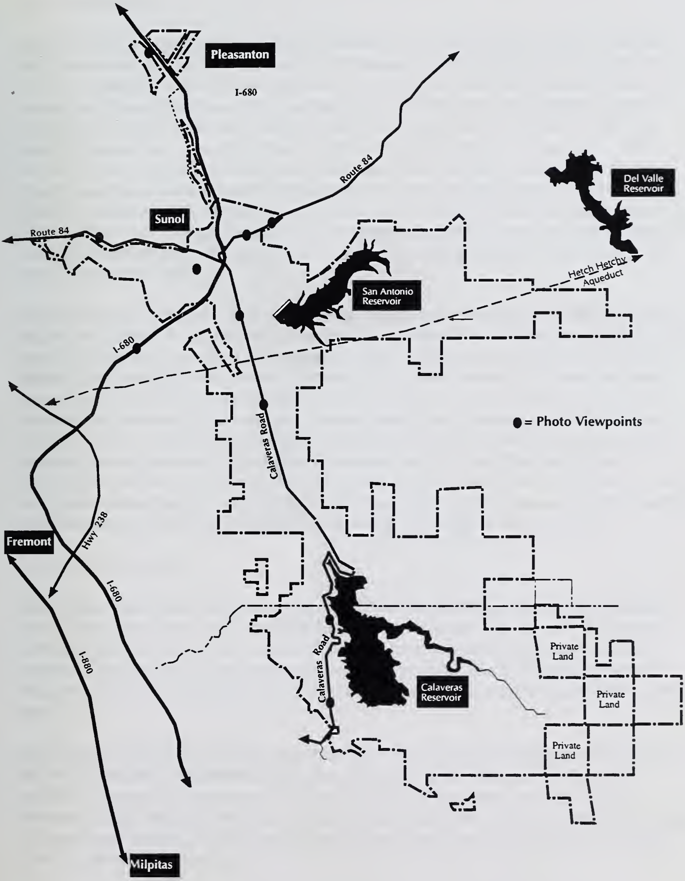


Photo 1-11 View southeast from Sunol Water Temple

Figure 1-1 Regional Map of the Alameda Watershed and Photo Viewpoints



1.3 Existing Visual Conditions

1.3.1 Interstate 680

Interstate 680 is a major freeway facility that connects the south bay communities of San Jose and Fremont with the East Bay communities of Pleasanton and Walnut Creek and points beyond. I-680 runs generally north-south through the cities of Walnut Creek and Pleasanton before curving west through the Sunol Valley and into the City of Fremont. The roadway ranges from 6 to 8 lanes in width. In general, watershed lands are viewed from the portion of I-680 from Mission Pass northeast through the Sunol Valley to the southern edge of Pleasanton. This portion of I-680 is designated as a State of California Scenic Highway. In response, Alameda County has adopted policies regarding the regulation of land use, development density, and signage to maintain scenic characteristics of views from the freeway. The watershed lands in the relatively flat Sunol Valley are prominently viewed from I-680, as are the west facing slopes of the hills on the east side of the valley. To the north, the forested Pleasanton and Sunol Ridges form the western horizon.

Although the area is predominantly natural in appearance and undeveloped, several major built features are visible from the freeway. These include an electric transmission line along the south side of the freeway, a second set of lines approximately 3/4 mile to the south, and the large parking lot and playing field at the Sunol Valley Golf Course. Several active sand and gravel quarries are located in the Sunol Valley area. The mining itself is not highly visible since it occurs below grade and for the most part, vantage points from surrounding roads are limited to at-grade locations. However, processing plants and conveyors are visible beyond the roadside berms and boxed specimen trees at adjacent nurseries that cover part of the valley floor. Although some of the quarry operations have resulted in open, water filled pits within the valley floor, these waterbodies are not generally visible from I-680. Further expansion of these quarries could increase their visibility, particularly if large new processing facilities are built.

1.3.2 Niles Canyon Road

Niles Canyon Road winds along the bottom of forested Niles Canyon, curving along Alameda Creek. Due to the curving of the road and the steep canyon slopes that rise up to 1,000 feet above the creek, views from the road are strongly enclosed and enframed. Canyon slopes and hillsides to the south of the road are densely vegetated while the south-facing hillsides on the north side of the road are generally covered in annual grasses with scattered California live oak trees.

Dense riparian vegetation associated with Alameda Creek is a significant feature of views from the road. Open fields and nursery crops at the eastern end of the road near I-680 give an agricultural character to road scenes. The Sunol Water Temple (part of the City of San Francisco's Hetch Hetchy System) is a unique landmark in the area. However, the Water Temple is located approximately 1/2-mile from SR 84/Paloma Road (Scott's Corner) and is not highly visible to travellers on the road.

1.3.3 Calaveras Road

Calaveras Road is designated as a scenic route by Alameda County. The southern portion of Calaveras Road is located in Santa Clara County and this portion of road is not designated as a scenic route. Calaveras Road links the community of Milpitas with I-680 near Scott's Corner; however, the length of the narrow, twisting route limits its use. The road provides for scenic, long distance views to the west as it crosses over the Fremont Hills and also provides for views of Calaveras Reservoir as the road winds along the east facing slope on the west side of the reservoir.

The area is generally composed of northeast-southwest trending canyons and hills. Repeated ridges are covered with a mix of oak savannah, oak woodland, grassland, bacharris brushland, and some pine forests. Views from the road in this area are generally natural in appearance. However, several man-made features are visible, including the Calaveras Test Site, consisting of several buildings at the south shore of Calaveras Reservoir; a transmission line located roughly parallel to Calaveras Road, and scattered residential developments located to the south of the watershed lands. The transmission line and associated right-of-way is not highly noticeable in views from Calaveras Road. The dam and waterway intake at the north end of the reservoir are also not highly visible or apparent. Several buildings are located on the eastern shore near the dam. As viewed from Calaveras Road, these buildings, and the dam, are relatively small in scale and are not highly visible.

Although the majority of the Alameda Watershed lands along Calaveras Road west of the reservoir are fenced, trespass has occurred at several locations along this route. The resulting damage to fencing and large amounts of roadside litter which detract from the scenic character of views at these locations.

North of the Reservoir, Calaveras Road is located in a relatively narrow valley (Alameda Creek) that widens to form the Sunol Valley at the confluence of Alameda Creek, San Antonio Creek, and Arroyo de la Laguna. The valley floor is agricultural in character, with a variety of nurseries, and other agricultural lands uses predominating. The SFWD Sunol Water Treatment Plant is effectively screened from view by trees and landform between Calaveras Road and the site. A transmission line is located relatively high on the ridge to the west and is not a dominant element of views.

As Calaveras Road enters the Sunol Valley, the most prevalent and highly visible land use are the nurseries located west of the road. Sand and gravel quarry operations are also visible but are not as noticeable as the many acres of box specimen trees. Views of the Sunol Valley from Calaveras Road include the multiple transmission lines located within the Hetch Hetchy right-of-way. Calaveras Road crosses under these lines south of Scott's Corner. The lines are highly visible as they cross the flat landscape of the Sunol Valley and traverse the east facing slopes of the Fremont Hills near Mission Pass.

1.3.4 Vallecitos Road

Vallecitos Road is designated as a scenic route by Alameda County. This rural road ranges in width from two to four lanes. Only a short portion of the road between I-680 and the Vallecitos Valley is located in Alameda Watershed lands. Views from the road in this area include grass covered slopes and large stands of oak trees. Further east, views of the north facing slopes that surround San Antonio reservoir are possible. These grass covered hills are visible at a distance of approximately 1 1/4 miles. Small, rustic agricultural buildings and residences are located at various points along the road. The General Electric Vallecitos Nuclear Center, located just north of Vallecitos Road, is the predominant man-made feature within this area. Other notable built features visible from this road include the electric transmission line located parallel to the road approximately 1 1/4 miles to the south. These transmission lines are located outside SFWD lands.

1.3.5 Geary Road

Geary Road is a Alameda County scenic route that connects Calaveras Road to Sunol Regional Wilderness, a portion of which consists of lands leased to the East Bay Regional Park District (EBRPD) by the SFWD. Geary Road is located east of Calaveras Road and closely follows the course of Alameda Creek. Views from the road are strongly enclosed by both the surrounding canyon and the riparian vegetation and oak woodlands along Alameda Creek.

1.3.6 Foothill Boulevard

Foothill Boulevard is located west of and parallel to I-680 between Pleasanton and Sunol. The Arroyo de la Laguna forms a corridor that includes I-680, Pleasanton-Sunol Road, Foothill Road, and the Western Pacific Railroad. Views to the west encompass the heavily forested Pleasanton Ridge, which is open space managed by the EBRPD. Residential development is located immediately adjacent to Foothill Road in this area, and contains extensive and mature landscaping. This development is associated with the Castlewood Country Club, a golf course located along the Arroyo de la Laguna on lands leased from the SFWD.

1.3.7 Sunol Water Temple

The Sunol Water Temple is located at the SFWD operations complex at the intersection of Niles Canyon Road and Calaveras Road. A walnut orchard implemented by the University of California was once located on Alameda Watershed property in the area surrounding the Sunol Water Temple. The orchard was later eradicated when the trees became diseased. Currently, the area around the Water Temple consists of open fields used for Alfalfa cultivation. The 1/2-mile long entry drive to the Water Temple is landscaped with a colonnade of oak tree saplings. Sand and gravel quarry operations are planned for the area adjacent to and east of the entry drive and south of SR 84/Paloma Road that is currently used for Alfalfa cultivation. Development of this area for sand and gravel extraction would result in a change in visual character and a reduction in the visual quality of the area as viewed from the Sunol Water Temple, the entry drive, and from SR 84/Paloma Road.

1.4 Visual Resource Policies and Guidelines

1.4.1 State of California

The State Scenic Highway System consists of a number of officially designated scenic roads, all of which are state highways. All state scenic routes are numbered state highways included in the "California Master Plan of State Highways Eligible for Official Scenic Highway Designation." Roads in the State Master Plan are officially designated as scenic routes after a determination has been made by the State that the road and right-of-way meet the state's "scenic highway standards" and that the scenic corridor of the road has been given adequate protection for the preservation of the resources. Bringing the road up to the scenic highway standards is the responsibility of the State; providing corridor protection is up to local governments. The local jurisdiction must develop a plan and implementation program for protection of the scenic corridor. I-680 is designated as a State Scenic Highway and provides views of Alameda Watershed lands.

1.4.2 Santa Clara County

The Santa Clara County General Plan includes routes in the county and state scenic road systems. However, no county designated scenic routes area located within, or provide views of, Alameda Watershed lands.

1.4.3 Alameda County

SFWD lands are designated as "Resource Management" in the Alameda County General Plan. The intent of this designation is that the lands remain as open space with water management as the primary emphasis. General Plan Policy 150 states that the County shall participate with the SFWD in its planning efforts for the SFWD-owned watershed lands within the Sunol Valley to ensure that future quarry activity is compatible with Sunol community interests and water management objectives. Sensitive ridgelines identified by the County include the Vargas Plateau and Sheridan Road areas that separate the communities of Fremont and Sunol.

The Scenic Route Element of the Alameda County General Plan identifies a continuous county-wide scenic route system. Alameda County designated scenic routes that provide views of Alameda Watershed lands include Calaveras Road, Foothill Road, Niles Canyon Road, Vallecitos Road, and Geary Road.

1.5 Visual Resource Management Issues/Objectives

Alameda Watershed lands generally occur as undeveloped and naturally appearing open space, indistinguishable from the other open space lands in the East Bay, including park and wilderness lands managed by the EBRPD. Watershed lands around San Antonio Reservoir are not visible from publicly accessible roads. SFWD lands that have a high degree of visibility and present visual resource management issues include the Sunol Valley, and the discontinuous parcels located immediately south of Pleasanton and at the base of Pleasanton Ridge. The following

discussion outlines the major visual resource issues for the Alameda Watershed.

1.5.1 Sunol Valley Sand and Gravel Extraction

Future sand and gravel quarry activities may result in adverse visual effects in the Sunol Valley area. A Specific Plan for the other area of concentrated sand and gravel quarries (the Amador Valley area) has been prepared that outlines the reclamation theme (Chain-of-Lakes) and the site specific reclamation plans. Under the proposed measures described in the Specific Plan, the current visual quality of this area will improve after reclamation. Alameda County General Plan Policy 150 states that the County shall participate with the SFWD in its planning efforts for the SFWD-owned watershed lands within the Sunol Valley, in order to ensure that future quarry activity is compatible with Sunol community interests and water management objectives. Future sand and gravel quarry operations that will be located closer to I-680 than the existing quarries should be carefully assessed for visibility from the freeway.

Future sand and gravel quarry activities near the Sunol Water Temple would be visible from SR 84/Paloma Road and the entry drive and immediate vicinity of the Sunol Water Temple. The area is currently used for Alfalfa production. The development of sand and gravel quarries would change the visual character of the area and would likely decrease the visual quality of the area as experienced by visitors to the Water Temple.

1.5.2 Trespass and Litter on Calaveras Road

Views from Calaveras Road are generally naturally appearing with little intrusion from obviously man-made elements. However, at various points along the length of the road that overlooks the reservoir, there has been repeated trespassing and large amounts of litter. Although the magnitude of this effect is limited by the nature of the visual change and the limited number of roadway users, the resulting visual effect is adverse.

2.0 PENINSULA WATERSHED

2.1 Introduction/Regional Setting

The Peninsula Watershed covers 23,000 acres of the San Francisco Peninsula, encompassing lands on the eastern slope of the Peninsula between Skyline Boulevard (SR 35) and Interstate Highway 280 (I-280). The Watershed is located in central San Mateo County. Land uses adjacent to the Watershed are predominantly residential to the north and east in San Carlos and Hillsborough and undeveloped private open space to the west. Land to the south of the Watershed is a mixture of open space and residential, and includes the Filoli Estate, a 600-acre site surrounded by SFWD land. I-280 borders the Watershed to the east, while State Route 92 (SR 92), which connects San Mateo and Half Moon Bay, bisects the Watershed between Upper and Lower Crystal Springs Reservoir. The predominantly natural Watershed contrasts with the heavily urbanized setting to the north, while maintaining the heavily wooded character of the eastern slope of the Santa Cruz Mountains to the south.

The western slopes of the Peninsula Watershed are heavily forested with a mixture of eucalyptus, Monterey cypress, pine, California bay, and coast live oak. This vegetation transitions to wide areas of chaparral and coastal scrub depending on soil types and slope aspect. The eastern edge of the watershed lands are markedly different in appearance than the lands viewed to the west of I-280. These lands consist primarily of grasslands with scattered oak woodlands. Key views in the area include views of Upper and Lower Crystal Springs Reservoir and San Andreas Lake from I-280, views of Upper and Lower Crystal Springs Reservoirs from SR 92, and views of Lower Crystal Springs Reservoir and San Andreas Lake from the Sawyer Camp Trail, a pedestrian/bicycle path that traverses the Peninsula Watershed's recreational easement on the west side of I-280. Features of interest in the area include the Pulgas Water Temple, located on SFWD lands along Canada Road; a large roadside statue of Father Junipero Serra at the Interstate 280 Safety Rest Area; the Eugene Doran Memorial Bridge on I-280 at San Mateo Creek. The Crystal Springs dam and vista point are located on SFWD lands immediately west of the Eugene Doran Bridge.

2.2 Key Observation Points

Key observation points have been identified based on federal, state, and county plans. Roads were identified based on designation in appropriate state or county plans as scenic routes. Other use areas were identified based on their importance, use volume, use duration, and size. These areas typically include designated vista points, trails, parks, and secondary roads to and from regional parks. The following viewpoints (shown in Photos 2-1 to 2-12) form the basis for the discussion of existing conditions. A regional map of the Watershed indicating the locations of these viewpoints is shown in Figure 2-1.

- Interstate Highway 280 (including Vista Point No. 1, Vista Point No. 2, Vista Point No. 3, and the Safety Rest Area)
- State Route 92
- Skyline Boulevard (State Route 35)

- Canada Road
- Crystal Springs Dam and Viewpoint
- Sawyer Camp Trail

Photo 2-1 View west from Vista Point No. 1 (east side of I-280)

Photo 2-2 View west from Vista Point No. 2 (east side of I-280)

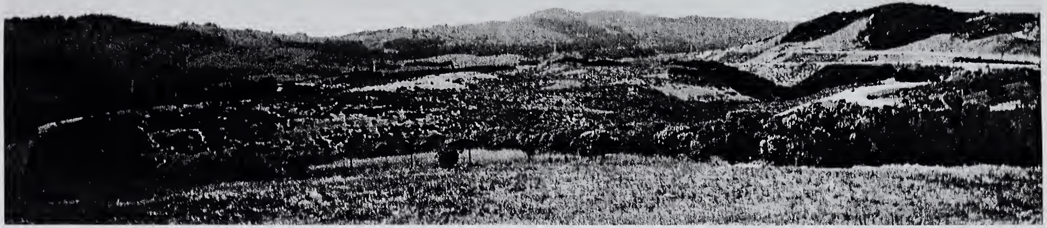


Photo 2-3 View west from Vista Point No. 3 (west side of I-280)

Photo 2-4 View west from I-280 Safety Rest Area (Cahill and Sawyer Ridge)

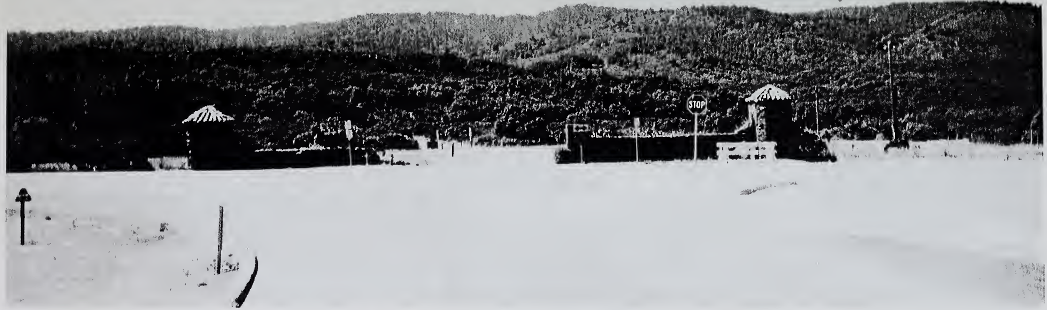


Photo 2-5 View west from intersection of Canada Road and Edgewood Road (Entrance to Phlager Estate)

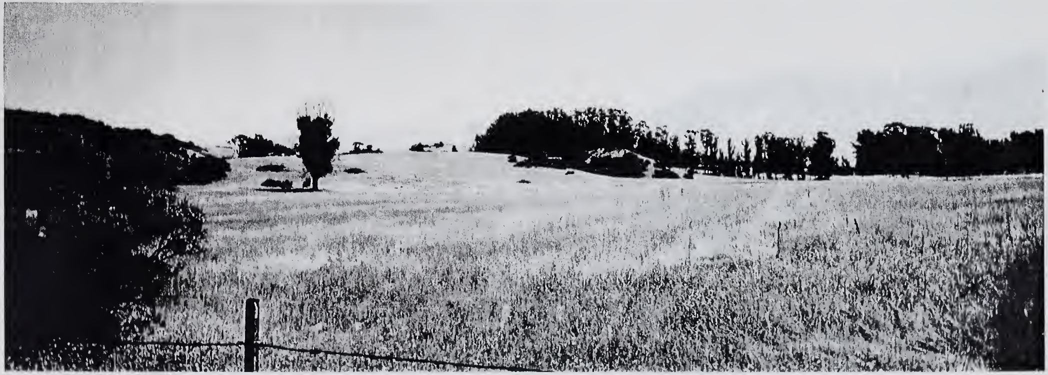


Photo 2-6 View southeast from intersection of Canada Road and Edgewood Road (Edgewood Triangle)

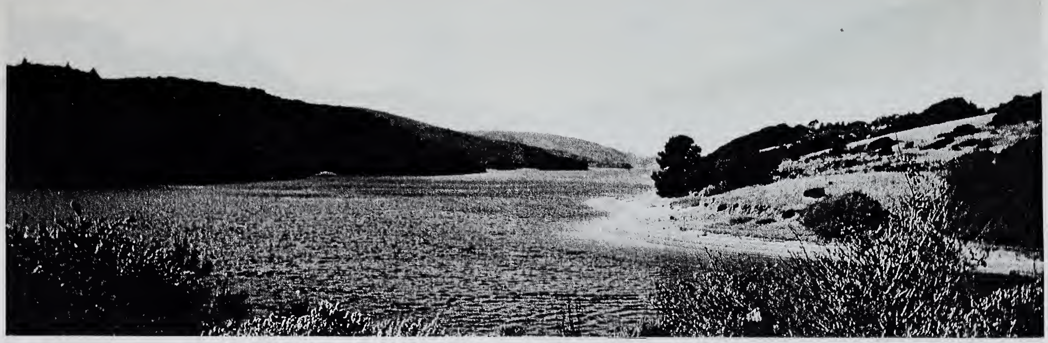


Photo 2-7 View northwest from Sawyer Camp Trail (Lower Crystal Springs Reservoir)

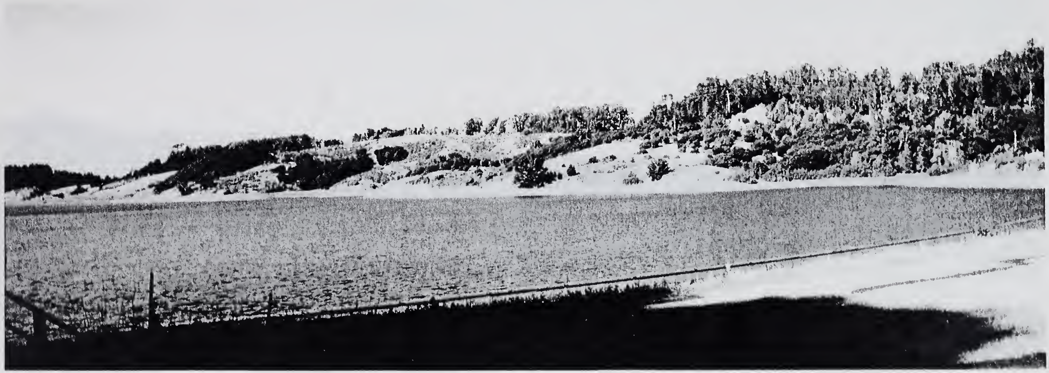


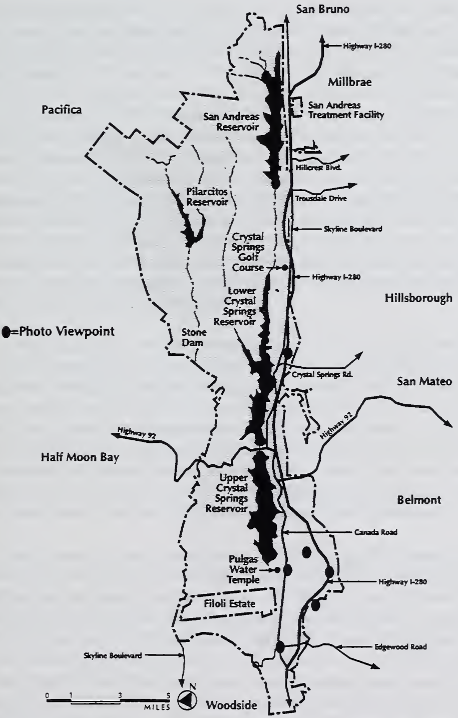
Photo 2-8 View northeast from Sawyer Camp Trail (San Andreas Lake and I-280)

Photo 2-9 View south from Sawyer Camp Trail (San Andreas Rift)

Photo 2-10 View west from Crystal Springs Vista Point

Photo 2-11 Pulgas Water Temple

Figure 2.1 Regional Map of the Peninsula Watershed and Photo Viewpoints



2.3 Existing Visual Conditions

2.3.1 Interstate 280

I-280 (Junipero Serra Freeway) forms the rough dividing line between the urban and rural areas of San Mateo County, and provides extensive views of the natural landscape to the west, including large expanses of rolling hills, forested slopes of the Santa Cruz Mountains, and Crystal Springs Reservoir. The portion of I-280 between San Francisco and State Highway 17 is included in the "California Master Plan of State Highways Eligible for Official Scenic Highway Designation." The portion of I-280 from the Santa Clara County line to Sneath Lane in San Bruno is officially designated as a State Scenic Route. In addition, the SFWD lands through which the freeway passes are within the boundaries of both a Scenic Easement and a Scenic and Recreation Easement, which originated in 1968 in conjunction with the proposed construction of I-280. The easements are intended to protect the natural scenic quality of the area and resulted from an agreement between SFWD, San Mateo County, the National Park Service (GGNRA), and the State of California (CalTrans). The freeway is a wide, 8-lane roadway. The northbound and eastbound travelways are often grade-separated and although large cut slopes are visible at some locations, the roadway is generally considered to be a responsive and high quality design that fits in well with the surrounding landscape.

Views from I-280 includes large areas of the east facing slopes of the Peninsula Watershed. The viewshed of I-280 is generally free from extensive development throughout the stretch of highway that passes through or along the Peninsula Watershed. While a limited amount of residential development is visible to the east, the watershed lands to the west are undeveloped and show little, if any signs of development as viewed from the freeway. The Crystal Springs Golf Course is located between I-280 and the northern portion of Lower Crystal Springs Reservoir. The majority of the golf course is screened from view by a dense stand of cypress trees on the west side of the freeway. Views of the golf course are limited to a short stretch of the southbound travel lanes near the I-280/Black Mountain Road Interchange.

The few developed features that are visible from the freeway include a transmission line that crosses the freeway in the vicinity of Black Mountain Road and the I-280/SR 92 Interchange, which includes several prominent overcrossing ramps. Views of San Andreas Lake and Upper and Lower Crystal Springs Reservoir from the freeway are intermittent. Lands immediately surrounding the highway consist of a grasslands that exhibit a seasonal change in color from green to light brown and gold. The slopes of the Watershed to the west of the highway consist of a mixture of dark green cypress trees, with larger areas of lighter green stands of mixed coniferous forest. Chaparral and coastal scrub covers the south facing slopes, while mixed coniferous forests are primarily located in the narrow valley bottoms and draws. The most visible portions of the Watershed are the heavily forested upper slopes of Sawyer and Cahill Ridge.

Four vista points are located along the stretch of Interstate 280 that provides views of watershed lands. These vista points are identified as follows:

Vista Point No. 1 - This vista point is located on the east side of I-280 approximately 3/4 mile north of Edgewood Road. This site is identified as "Panoramic Overlook" on Exhibit "A" of the Grant of Scenic Easement for the Peninsula Watershed.

Vista Point No. 2 - This vista point is located on the east side of I-280 approximately 2 miles north of Edgewood Road. This site is identified as "Vista Point" on Exhibit "A" of the Grant of Scenic Easement for the Peninsula Watershed.

Vista Point No. 3 - This vista point is located on the west side of I-280, approximately 2 1/2 miles north of Edgewood Road. This site is identified as "West Vista Point" on Exhibit "A" of the Grant of Scenic Easement for the Peninsula Watershed.

I-280 Safety Rest Area - This CalTrans Safety Rest Area is located on the east side of I-280 between the Eugene Doran Bridge (San Mateo Creek) and the Bunker Hill/I-280 Interchange.

As viewed from these vista points, the Peninsula Watershed lands appear as undeveloped and natural open space. Vista points 1, 2, and 3 are located relatively high on the hillsides along I-280 and the elevated viewing positions offer a panoramic view of the forested slopes of the Peninsula Watershed, as well as prominent views of the three reservoirs in the San Andreas Valley. Vista Points 1 and 2 also provide for extensive views of the highly urbanized San Mateo County area and the San Francisco Bay to the east.

Relatively few man-made features are visible within or adjacent to the Peninsula Watershed from these vantage points. Portions of SR 92 are visible on the east facing slopes above Upper and Lower Crystal Springs Reservoir, and several antennas and small structures are visible on the skyline in the vicinity of the SR 92 and SR 35 intersection. However, these features are small in scale and are not highly noticeable. Each of the vista points are located well off the main freeway, and while this separation provides for a higher quality viewing experience, the relative number of visitors is likely to be relatively low because travellers on the freeway are offered little incentive to stop.

The Safety Rest Area is located adjacent to I-280, with an easily accessible parking area and restroom facilities. Due to the ease of access from the freeway and the prominent and distinctive statue of Junipero Serra, the Rest Area and associated viewpoint is likely to receive more visitation than the three vista points previously discussed. A pathway leads to a viewpoint located at the base of a large statue of Junipero Serra. Views at this location are oriented to the west, and include the freeway, Lower Crystal Springs Reservoir, and the forested slopes below Sawyer Ridge. The statue of Junipero Serra is a distinctive and prominent landmark for travellers on I-280.

2.3.2 State Route 92

SR 92 is neither an officially designated State Scenic highway nor is it identified on the State Scenic Highway Master Plan. SR 92 is, however, identified as a San Mateo County scenic

corridor. In addition, the SFWD lands through which the highway passes are within the boundary of the Scenic Easement and Scenic and Recreation Easement described previously.

From west to east, views of SFWD watershed lands from SR 92 begin at the summit of the Santa Cruz Mountains (Skyline Boulevard/SR 92 Intersection). Panoramic views to the east are available from the area around the intersection. As SR 92 curves down the eastern slope of the Santa Cruz Mountains, views become enclosed by dense stands of trees and shrubland. These trees include large, even-age stands of Monterey cypress that in addition to blocking views from the road, serve to block views of the road and associated roadcuts from a variety of locations to the east, including I-280. Continuing eastward, SR 92 passes between Upper and Lower Crystal Springs Reservoir on a causeway that provides prominent views of both reservoirs, and of the grass covered hillsides to the east for eastbound motorists and the densely forested slopes of Cahill Ridge. A portion of the upper slopes of the abandoned Skyline Quarry, located north of SR 92 on the shoreline of Lower Crystal Springs Reservoir, is visible from westbound SR 92.

SR 92 is undergoing a CalTrans Improvement Project (slow vehicle lane/safety improvements from Route 35 South to Interstate Route 280). Construction of the roadway improvements will result in removal of existing vegetation and exposed slopes which would be viewed from a variety of locations. A revegetation program with erosion control grasses and replacement plantings is proposed as part of the project to lessen visual impacts. Consideration has been given to the revegetation/restoration of Skyline Quarry as part of the mitigation for the SR 92 improvements. Mitigation measures recommended by CalTrans for the improvement project include the following:

- using the quarry to store sedimentation from excavation;
- restoring the quarry;
- relocating wetlands; and
- replacing riparian oaks.

2.3.3 State Route 35

SR 35 (Skyline Boulevard) follows the western boundary of the Peninsula Watershed along the summit of the Santa Cruz Mountains north to the SR 35/SR 92 intersection. From this point, SR 35 and SR 92 form a combined route which winds down through the Peninsula Watershed, before crossing between Upper and Lower Crystal Springs Reservoirs on a causeway. East of the causeway, SR 35 is routed north along the western shore of Lower Crystal Springs Reservoir, crossing over Crystal Springs Dam before climbing a steep grade and eventually connecting to I-280.

SR 35 (Skyline Boulevard) is included in the "California Master Plan of State Highways Eligible for Official Scenic Highway Designation." The portion of SR 35 from the Santa Cruz-San Mateo County boundaries to SR 92 in San Mateo County has been officially designated as a State Scenic Route. The road is also designated as a scenic route by Santa Clara and San Mateo County. A Scenic Access Point is located at the SR 92/SR 35 intersection. This area provides views of Upper Crystal Springs Reservoir and grasslands in the eastern portion of the Watershed.

corridor. In addition, the SFWD lands through which the highway passes are within the boundary of the Scenic Easement and Scenic and Recreation Easement described previously.

From west to east, views of SFWD watershed lands from SR 92 begin at the summit of the Santa Cruz Mountains (Skyline Boulevard/SR 92 Intersection). Panoramic views to the east are available from the area around the intersection. As SR 92 curves down the eastern slope of the Santa Cruz Mountains, views become enclosed by dense stands of trees and shrubland. These trees include large, even-age stands of Monterey cypress that in addition to blocking views from the road, serve to block views of the road and associated roadcuts from a variety of locations to the east, including I-280. Continuing eastward, SR 92 passes between Upper and Lower Crystal Springs Reservoir on a causeway that provides prominent views of both reservoirs, and of the grass covered hillsides to the east for eastbound motorists and the densely forested slopes of Cahill Ridge. A portion of the upper slopes of the abandoned Skyline Quarry, located north of SR 92 on the shoreline of Lower Crystal Springs Reservoir, is visible from westbound SR 92.

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- using the quarry to store sedimentation from excavation;
- restoring the quarry;
- relocating wetlands; and
- replacing riparian oaks.

2.3.3 State Route 35

SR 35 (Skyline Boulevard) follows the western boundary of the Peninsula Watershed along the summit of the Santa Cruz Mountains north to the SR 35/SR 92 intersection. From this point, SR 35 and SR 92 form a combined route which winds down through the Peninsula Watershed, before crossing between Upper and Lower Crystal Springs Reservoirs on a causeway. East of the causeway, SR 35 is routed north along the western shore of Lower Crystal Springs Reservoir, crossing over Crystal Springs Dam before climbing a steep grade and eventually connecting to I-280.

SR 35 (Skyline Boulevard) is included in the "California Master Plan of State Highways Eligible for Official Scenic Highway Designation." The portion of SR 35 from the Santa Cruz-San Mateo County boundaries to SR 92 in San Mateo County has been officially designated as a State Scenic Route. The road is also designated as a scenic route by Santa Clara and San Mateo County. A Scenic Access Point is located at the SR 92/SR 35 intersection. This area provides views of Upper Crystal Springs Reservoir and grasslands in the eastern portion of the Watershed.

Foreground views from this area include stands of Monterey cypress and chaparral/coastal scrub. In general, the viewshed of SR 35 along the western boundary of the Peninsula Watershed is extremely limited, screened by the dense stands of evergreen trees along both sides of the road. Views to the west occasionally open up; however views to the east into the Watershed are blocked by roadside vegetation. The landscape as viewed from SR 35 is generally undeveloped and natural in appearance. Intermittent views of residences occur as the road curves along the ridgetop. In addition, there are occasional views of the Skylawn Cemetery from SR 35 immediately south of SR 92.

Views from SR 35 on the eastern side of Lower Crystal Springs Reservoir include expansive views of the reservoir and of the forested slopes of the Peninsula Watershed. This section of SR 35 offers striking and memorable views of the reservoir as the road crosses over the top of Crystal Springs Dam. This portion of SR 35 also offers views of the San Mateo Creek canyon and the distinctive Eugene Doran Bridge. North of Crystal Springs Road, both sides of the relatively narrow, two-lane SR 35 are often crowded with parked cars from visitors to the Sawyer Camp Trail. The large number of parked cars along this stretch of road creates a degree of visual disorder and clutter to an otherwise natural and scenic character.

2.3.4 Canada Road

Canada Road traverses the east side of San Andreas Valley, running through SFWD lands. Canada Road offers a relatively quiet bypass to I-280 for leisurely driving and is a popular recreational bicycle route. The road is closed to automobile traffic three weekend days each month between Edgewood Road and State Route 92 for the exclusive recreational use of runners, hikers and bicyclists. The intersection of Edgewood Road and Canada Road is a popular parking and staging area for cyclists and runners that use the closed portion of the road on Sundays. Canada Road offers extensive views of the forested Santa Cruz Mountains, the grass covered hills on the east side of the valley, Upper Crystal Springs Reservoir, and the Pulgas Water Temple.

2.3.5 Crystal Springs Dam and Viewpoint

Crystal Springs Dam and viewpoint are located near the intersection of SR 35 and Crystal Springs Road on the east shore of Lower Crystal Springs Reservoir. This site is heavily visited due to the staging area/trailhead for the Sawyer Camp Trail, which begins just north of the dam and vista point and heads north along the shoreline of the reservoir. SR 35 crosses over the top of Crystal Springs Dam and provides extensive and close range views of the dam itself (built in 1890 and designated as a historic Civil Engineering Landmark), Lower Crystal Springs Reservoir, the steep and heavily forested San Mateo Creek drainage, and the distinctive form of the Eugene Doran Bridge which spans the canyon to the east of the dam. The extreme height of the bridge, its curvilinear support columns, and the surrounding natural beauty of the scene combine to provide a unique and high quality viewing experience quite different from views for motorists on I-280 from the bridge. A vista point is located on the west side of SR 35 immediately north of the dam. The vista point includes a small parking area and informational signage. The existing shoreline vegetation at the site partially blocks views of the Lower Crystal

Springs Reservoir and the forested watershed lands from view. While this vegetation helps to block wind, the scenic quality of this vista point could be improved by selective vegetation removal.

2.3.6 Sawyer Camp Trail

The Sawyer Camp Trail is a popular recreation pedestrian/bicycle trail that traverses the western edge of the Peninsula Watershed between San Andreas Lake and Crystal Springs Dam. The trail is routed to the west of San Andreas Lake, then crosses over the dam at the south end of the lake before traversing a relatively remote and heavily forested area in the San Andreas Valley between San Andreas Lake and Lower Crystal Springs Reservoir. The trail is then routed along the west shoreline of Lower Crystal Springs Reservoir until it connects with Skyline Boulevard at Crystal Springs dam. Views from the trail include a variety of vegetation communities including grassland, oak woodland, and dense riparian vegetation. In some locations the trail is heavily screened and shaded and the reservoir water surface is not visible. At other locations, the shoreline vegetation is low and allows for sweeping views of the water surface of the reservoir and of the forested slopes of the watershed lands. In all cases, views from the trail are naturally appearing and of high scenic quality. At certain times, the drawdown of the reservoir leaves a noticeable line of exposed soil above the water surface. I-280 is not a highly noticeable feature of views from the trail.

2.4 Existing Visual Resource Policies and Guidelines

2.4.1 U.S. Department of Interior, Golden Gate National Recreation Area - Scenic Easement and Scenic and Recreation Easement

In the mid-1960s, I-280 was constructed southward, as far east of the SFWD reservoirs as possible. In consideration of the previously agreed relocation of I-280 to the current alignment, the City of San Francisco granted unto the United States an "estate, interest, and scenic and recreation easement" over the entire Watershed. The surrounding land was deeded to the federal government to administer the easement, then given over to GGNRA administration in the mid-1970s. The GGNRA is responsible for protecting scenic values and the SFWD is responsible for land management. This 1969 Scenic and Recreation easement includes roughly 19,000 acres in the Scenic Easement and 4,000 acres in the Recreation Easement.

Under the legal terms of the easements, the SFWD is permitted to conduct any activity on its lands, without GGNRA concurrence, as long as it pertains to water delivery. The Scenic and Recreation Easement allows for a Scenic Highway (SR 35 - Skyline Drive) and trails for hiking (Sawyer Camp Trail). The easement states:

1) The land shall be preserved in its present natural state and shall not be used for any purpose other than for the collection, storage and transmission of water and protection of water quality, and other purposes which shall be compatible with said use and preserving said land as open-space land;

2) No structures shall be erected upon said land except such structures as may be directly related to and compatible with the aforesaid uses. No trailer shall be placed, used or maintained on said land as a substitute for a caretaker's residential building. The design and location of all buildings except water utilities buildings and appurtenances, shall be subject to the concurrence of a regional representative of the Department of the Interior to be designated by the Secretary of the Interior;

4) No signs, billboards or advertisements, excepting directional signs and identification signs in connection with permitted uses, shall be displayed or placed upon the land;

6) (a) Except as required to accomplish the improvements hereinafter permitted or as otherwise permitted to the Grantor hereunder, the general topography of the landscape shall be maintained in its present condition and no substantial excavation or topographic changes shall be made without the concurrence of a regional representative of the Department of the Interior to be designated by the Secretary of the Interior; and

7) Except as required to accomplish the purposes and uses herein permitted to Grantor, there shall be no cutting or permitting of cutting, destroying or removing any timber or brush without the concurrence in writing by a regional representative of the Department of the Interior to be designated by the Secretary of the Interior.

2.4.2 State of California

Portions of the Peninsula Watershed lands are visible within the Junipero Serra (I-280) Scenic Corridor, which is generally located west of the Interstate between Redwood City and Millbrae. A portion of the watershed lands are also visible from the Skyline Scenic Corridor (SR 35), located at the western boundary of the Peninsula Watershed south of SR 92.

2.4.3 County of San Mateo

San Mateo County General Plan policies that relate to visual resources include the Conservation and Open Space Element (1973), the Scenic Roads Element (1975), and the Skyline-Santa Cruz Mountains Area Study (1983). Other county controls affecting the appearance of development are resolutions and policy standards applicable to scenic corridors. These scenic corridor controls are oriented toward protecting rural character by controlling the design and appearance of structures and equipment located within these corridors. SR 92 and SR 35 are identified as scenic corridors within San Mateo County.

2.5 Visual Resource Management Issues/Objectives

Peninsula Watershed lands generally occur as undeveloped and naturally appearing open space, indistinguishable from the other open space lands on the San Francisco Peninsula, including lands managed by the Mid-Peninsula Open Space District. The Peninsula Watershed consists of a series of deeply folded north-south trending valleys and ridges, of which only a portion of the east facing slopes are visible from publicly accessible roads and viewpoints that are generally

located on the east side of the San Andreas Valley. In general, no structures or roads are visible on the Peninsula Watershed. Visual resource management issues on the Peninsula Watershed therefore are oriented toward the management of vegetation and the retention of full-pool water elevations in the three reservoirs that are visible from key viewpoints. The following discussion outlines the major visual resource issues for the Peninsula Watershed.

2.5.1 Fuels Management

Because fire has not occurred on the Peninsula Watershed for over a century, these lands are highly vulnerable to fire. Methods for fire management used by California Department of Forestry (CDF) primarily include prescribed fire, as well as alternative methods such as vegetation management by hand crews. CDF typically conducts prescribed burns of 45 acres per year. The burn frequency and time of year depends upon whether or not rare or endangered species, such as listed plant species or nesting birds, are present. Prior to approval of a prescribed burn program, a land management plan is required that addresses archaeological and cultural issues. Future planning for vegetation management on the Peninsula Watershed should identify priority burn areas, then design a mosaic of burns, beginning with cool season burns (winter, fall, and spring) that cover relatively small areas that allow for restoration and revegetation. During these cool times, new vegetative species often surface during the post burn restoration process.

2.5.2 Non-native Vegetation/SR 92 Screening

If vegetation management goals include the eradication of exotic species on the Watershed, particularly the Monterey cypress, the goal should be to eradicate this species slowly over time and let natural species of trees with similar screening characteristics, grow back. This issue is particularly important along SR 92, where the existing Monterey cypress trees screen views of the highway and associated road cuts from a variety of locations to the east.

Improvement plans and projects for roads within the Peninsula Watershed should be reviewed for potential visibility from the surrounding lands to the east. In general, the existing roads within the Peninsula Watershed are not visible from the roads and public use areas to the east; however, potential exists for road widening and vegetation removal within the Watershed to be visible from key viewpoints to the east.

2.5.3 South Watershed Golf Course

Various proposals for a second golf course on the Peninsula Watershed have been developed and considered. These proposals have focused on the southern portion of the Peninsula Watershed, an area of flat to gently rolling, open grassland. Recent proposals have focused on the Edgewood County Park site and the Edgewood Triangle, areas located southeast of Edgewood Road and east of Canada Road and I-280. Currently, the area located southeast of Edgewood Road (i.e., the entrance road to the Phlager Estate) and west of Canada Road and I-280 are being proposed for development as a golf course. The area is visible from Canada Road, the parking area for bicyclists, joggers and other recreationists at the Edgewood Road/Canada Road intersection, the

entry road to the Phlager Estate (listed on the National Register of Historic Places), and to a lesser extent from I-280). The area is generally natural in appearance, consisting of grassland, scattered oak woodland, and some stands of eucalyptus trees. Due to the site's high visibility from roads with county or federal scenic route designation (i.e., Canada Road and I-280 respectively), the change in the existing visual character of the area due to golf course development, associated buildings, and parking areas would be an important planning consideration.

2.5.4 Crystal Springs Dam Viewpoint

The visual quality of the vista point located north of Crystal Springs Dam may be improved by site analysis and selective thinning of vegetation to improve/enhance views of Lower Crystal Springs Reservoir.

2.5.5 Sawyer Camp Trail Trailhead (SR 35)

The presence of parked cars along the narrow stretch of SR 35 north of Crystal Springs Dam and the SR 35/Crystal Springs Road intersection results in a adverse visual effect for views from the road. The control of on-street parking through the use of signage and the development of parking/staging areas for the Sawyer Camp Trail would result in a beneficial visual effect.

2.5.6 Water Surface Level Fluctuations

Reservoir water surface level fluctuation in Upper Crystal Springs Reservoir, Lower Crystal Springs Reservoir, and San Andreas Lake have the potential to introduce a highly apparent man-induced element into an otherwise natural appearing setting. In general, the operation of the SFWD system maintains these reservoirs at a fairly constant level; however, water level fluctuations do leave a noticeable line of exposed and bare soil, particularly in the steep and heavily forested sections of the shoreline.

REFERENCES

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Appendix C-6

Technical Memorandum #5
Best Management Practices
(to be completed)

Appendix C-7

Technical Memorandum #6
Economic Profile of Watershed Land Management by the San Francisco Water Department
November 1993

TECHNICAL MEMORANDUM NO. 6

DATE: November, 1993; Revised May, 1994 and July, 1995

TO: **EDAW**

FROM: **Pryde Roberts Carr**

SUBJ: **ECONOMIC PROFILE OF WATERSHED LAND MANAGEMENT BY THE SAN FRANCISCO WATER DEPARTMENT**

This technical memorandum provides results of the first of two phases of economic analysis of watershed land management policies and practices of the San Francisco Water Department (SFWD). The purpose of this memorandum is to provide an economic profile of watershed lands and to establish a baseline against which to measure and compare costs for watershed land use alternatives in the next phase of analysis. To develop this profile, meetings and discussions were held with managers and personnel responsible for watershed management. Data were gathered from a number of other sources, including:[1]

- Water Department budgets and fiscal reports
- Memoranda and reports from public meetings
- Information derived from a tour of the watersheds
- Other reports and documents on watershed land uses

This profile:

(1) Defines the general fiscal structure of the San Francisco Water Department and identifies relevant revenues and expenditure categories;

(2) Describes current watershed land use policies and practices;

(3) Identifies benefits and disadvantages associated with current and potential land uses;

(4) Identifies economic issues potentially applicable to analysis of land use and management alternatives in the next phase.

This memorandum represents a starting point for understanding the economic and potential fiscal impacts of changing watershed land uses, and will serve as the basis for establishing the analytical focus for the next phase.

FISCAL STRUCTURE OF THE SAN FRANCISCO WATER DEPARTMENT

The San Francisco Water Department is an "enterprise agency" of the City of San Francisco which is in the business of selling water to residential, commercial and industrial consumers. Water is sold retail to customers in the City and is supplied wholesale to 30 suburban agencies in Alameda, Santa Clara and San Mateo Counties. There are about 2.5 million consumers of the Water Department's product.

Watershed management is the responsibility of the Watershed Management Section of the Water Supply and Treatment Division. This division is responsible for overseeing the watersheds and maintaining suburban transmission and delivery facilities.

Departmental Budget Overview

An analysis was performed of the latest available annual budget for the San Francisco Water Department in order to develop an overview of its fundamental economic structure and to identify line items that apply to the management of watershed lands.[2] Water Department Revenues for 1992-93 were projected at $118 million, of which nearly $102 million was from City and suburban water sales. The remainder of revenues were from interest, service charges, rents and miscellaneous sources. Table 1 shows Water Department revenues for the 1992-93 fiscal year.

TABLE 1.
WATER DEPARTMENT REVENUES
1992-93 APPROVED BUDGET

SOURCES OF REVENUES	WATER DEPT. REVENUE 1992-93 BUDGET	PERCENT FROM SOURCE
Unappropriated Balance	$ 7,059,609	6.0
City Water Sales	43,572,753	36.9
Suburban Water Sales	57,965,227	49.1
Rents	3,883,000	3.3
Interest	2,250,000	[illegible].9
Miscellaneous	1,100,000	0.9
Service Charges	2,300,000	1.9
TOTAL	$ 118,130,589	100.0

Source: San Francisco Water Department

Expenditures for the Department were projected at $94 million for 1992-93, with $51 million for operations, $7 million for the Public Utilities Commission, $16 million for debt service, and nearly $20 million for all other types of expenditures. Table 2 shows amounts and proportions of funds allocated for the various Water Department expenditures for 1992-93.

TABLE 2.

WATER DEPARTMENT EXPENDITURES
1992-93 APPROVED BUDGET

ALLOCATION OF FUNDS	WATER DEPT. REVENUE 1992-93 BUDGET	PERCENT OF TOTAL FUNDS EXPENDED
Operations	$50,795,287	53.89%
Services of PUC	7,408,945	7.86%
Debt Service	16,379,288	17.38%
Other Expenditures	19,679,177	20.88%
SUBTOTAL	**$94,262,689**	100.00%
Capital Reserves	23,867,900	--
TOTAL	**$118,130,589**	--

Source: San Francisco Water Department

Watershed-Related Revenues

Revenue generating activities of the Water Supply and Treatment Division are associated with real estate managed by the Land Section. Three types of revenues are attributed to watershed lands: land leases, property tax reimbursements and land use permits. In the 1992-1993 budget, Agriculture and Land was slated to generate $3.9 million in revenues. In 1993-1994, the latest year for which actual figures are available, a total of $2.6 million was derived from Agricultural and Land revenue-generating activities.[3]

There are two forms of lease agreements: agricultural leases and non-agricultural leases, and two types of revenue-producing land use permits.

> **Agricultural leases** cover 65 specific parcels, with estimated total area of roughly 38,000 acres. The leases are for uses such as grazing, agriculture (e.g. grain, orchards) and horticulture (e.g. plant nurseries). In 1993-1994 there were twenty-

six agricultural leases covering a total of nearly 27,000 acres, with parcel sizes ranging from 6 acres to 10,000 acres. An estimated $342,147 in revenues were produced by these leases in 1993-1994.

Non-agricultural leases cover parcels on both watersheds, with many clearly in developed urban areas. Approximately 4,100 acres are covered by non-agricultural leases, with parcels ranging in size from tiny fractions of an acre to nearly 3,000 acres. Uses covered by these non-agricultural leases include a variety of different types of land uses, including grazing, nurseries and quarry operations of the type also covered under the agricultural leases. Other uses include parking/landscaping, recreation, and commercial operations. There were 10 non-agricultural leases producing $2,190,000 of revenue in the year ended June 30, 1994.

Land Use permits are conveyed for specific activities such as park sites, commercial activities, right-of-ways, parking/landscaping and road access, storage, erection of appurtenances or equipment, etc. Some of the permits covered grazing, apiary and horticultural operations. In 1993-1994, there were 26 revenue permits producing revenues of $44,900 on 3,800 acres, with parcels ranging from small fractions of an acre to nearly 2,000 acres.

Table 3 shows 1993-1994 lease and tax revenues by form of agreement between the payee and the Water Department.

Table 3
LAND SECTION REVENUES BY TYPE OF AGREEMENT (YEAR ENDING JUNE 30, 1994)

TYPE OF AGREEMENT	NO.	REVENUES
Agricultural Leases	28	342,200
Non-agricultural Leases (including taxes)	66	2,190,000
Land Use Permits	173	44,900
Total	511	2,577,100

Source: San Francisco Water Department

Using the 1993-1994 fiscal report, revenues were computed by type of land use. The results, presented in Table 4, provide a gross estimate of revenues attributed to a major land use categories.

Table 4
LAND SECTION REVENUES FROM LEASES AND PERMITS BY TYPE OF LAND USE (YEAR ENDING JUNE 30, 1994)

LAND USES	REVENUES
Grazing	$228,600
Nurseries and Other Agricultural Uses	124,500
Quarries and Related Uses	1,225,600
Golf Courses	785,500
Other Recreational (trails, bike paths, etc.)	52,700
Commercial Operations	97,700
Parking, Landscaping and Access	2,400
Utilities, Communications and Pipelines	10,300
Other Permitted Uses	1
Property Tax Reimbursements	49,800
TOTAL	2,577,100

Source: San Francisco Water Department & Pryde Roberts Carr

Revenues of $2,577,100 were generated form a variety of land uses which include grazing, agricultural uses, quarries, golf courses, other recreation, commercial operations, parking and landscaping, utilities and pipelines, tax reimbursements, and other permitted uses. All of the revenue from these land use were derived form leases and permits on SFWD-owned watershed lands.

For further breakdown of watershed related revenues, refer to Table 9.

Expenditures for Watershed Operations

The budget format currently used by the Department does not provide detail below the division level, so Land Use Section expenditures are not identified separately, except for personnel and capital improvements. Furthermore, line item expenditures in the Department's operations budget are not allocated to specific activities or projects so there

is no way to tie expenditures to activities specifically related to watershed operations, or to differentiate between costs on the Peninsula versus the Alameda sides.

The lowest level for which a breakdown is available is the Water Treatment and Supply Division, which had total budgeted expenditures of $18,247,789 for Fiscal Year 1992-93. Table 5 lists major budget line items and amounts for the Division's operations budget.

TABLE 5.

WATER SUPPLY AND TREATMENT DIVISION EXPENDITURES (YEAR ENDING JUNE 30, 1992)

BUDGET LINE ITEMS	EXPENDITURES	% OF TOTAL
Personnel expenses	$10,966,828	60.0
Contractual and other services	397,227	2.1
Payments to other governments	11,000	*
Taxes	1,981,000	10.8
Fees and licenses	62,103	0.3
Water/sewage treatment materials and supplies	1,597,500	8.7
Construction materials	216,000	1.1
Vehicle parts/supplies	154,300	0.8
Equipment maintenance	102,500	0.5
Fuels/lubricants	125,000	0.5
Other materials and supplies	308,180	1.6
Equipment Purchases	404,697	2.2
Services of Other Departments	1,921,454	10.5
TOTAL EXPENDITURES	$18,247,789	100.0**

Source: San Francisco Water Department

* Less than 1 percent
** May not add to 100 percent due to rounding

Overall, Water Treatment and Supply Division personnel expenses were $11 million, 60 percent of its $18 million budget. Of this amount, an estimated $1.1 million was allocated for 20 personnel assigned to watershed functions, including 14 watershed keepers and three

foresters. This allocation covers wages, holiday pay, fringe benefits, overtime pay and pay for extended workweeks. Table 6 identifies the specific positions and approximate total annual cost for each.

TABLE 6.

WATERSHED PERSONNEL (1992-93 APPROVED BUDGET)

POSITION TITLE	NUMBER	APPROXIMATE COST*
Executive Secretary**	1	$48,216
Urban Forester	2	140,165
Watershed Forester	1	63,876
Watershed Manager	1	75,469
Watershed Keeper Supervisor	1	75,971
Watershed Keeper	14	939,478
TOTAL	**20**	**$1,343,175**
Source: San Francisco Water Department		

* Includes wages, holidays, overtime pay, pay for extended workweeks, and fringe benefits at 20.9 percent.

** Executive Secretary paid out of budget for Capital Improvement Projects

The second largest budget line item is nearly $2 million for taxes. This expenditure is for property taxes paid to the jurisdictions in which the Department has land holdings. Most of the property owned by the Department is for the two watersheds and land traversed by the Department's pipelines. Approximately $1.3 million of the taxes are for land in the two watersheds. As described above, property tax reimbursements are made by leasees and permit holders for the amount of taxes paid by the Department for the parcels under lease or permit.

Services of other City government departments cost the Division $1.9 million, with the Bureau of Light, Heat and Power getting $1.8 million of that. Materials and supplies for water and sewage treatment are budgeted at $1.6 million. About $12 million was expended on equipment purchases and maintenance, contractual services (such as janitorial, vehicle rental, pest control etc.), parts and supplies, construction materials, and fees and licenses. (See Table 5.)

In addition to the operations budget, there is a budget for capital improvement projects. This is a line-item budget that specifies the cost of specific improvements, associated plans, studies and Department personnel costs. For fiscal year 1992-93 the capital improvements budget for watershed-related projects was $2.6 million; for 1993-94 it is projected at $1 million. Table 7 provides the projects and amounts appropriated for watershed improvements for these two years.

TABLE 7.

WATERSHED-RELATED
CAPITAL IMPROVEMENT PROJECTS BUDGETED

PROJECT	1992-93*	1993-94**
Watershed Land Erosion (Personnel Expenses)	$1,183,000	--
Construct and Restore Fences	200,000	50,000
Grade and Resurface Roads	363,000	55,000
Watershed Management Plans	825,000	562,500
Watershed Fire & Erosion Prevention	--	200,000
TOTAL	**$867,500**	**$1,017,500**

Source: San Francisco Water Department

* Approved budget
** Appropriated amount

FISCAL POLICIES AND COSTS

The Land Section is evolving toward optimizing watershed revenues, rather than the Department's past orientation toward maximizing revenues. Many of the fiscal and economic issues associated with watershed management and operations are generic in nature and apply to both watersheds. Some cross many management functions and projects; others are related to specific uses. In this and subsequent economic analysis of alternative land uses and watershed operational strategies, the focal point will be the types of costs that could be significantly affected by changes in land use or land management policies. Such cost categories, include, but are not limited to, the following:

Personnel expenses (operations and administrative)
Road management and maintenance
Fencing
Risk Management
Parking management
Equipment acquisition and maintenance

Solid waste management
Lease and permit management
Trail management and maintenance
Management and control of recreation uses
Forest management
Watershed protection
Land holdings and acquisitions
Sanitation (recreation related)
Capital cost of developing new and alternative uses
Information services and public information
Tax liabilities (to other counties)
Cost of regulatory compliance
Cost of extra water treatment and other mitigation
Legal expenses and litigation costs
Policing and security

These cost categories served as a guide to identifying the relevant economic issues associated with current watershed land use and management practices. Those which are most clearly associated with likely alternative proposals, such as increased recreation, lease management and agricultural uses are discussed in this memorandum. Generic economic and fiscal issues related to both watersheds are presented first, followed by issues specific to the Peninsula and Alameda Watersheds.

ISSUES AFFECTING BOTH WATERSHEDS

Adjacent Development

On both watersheds urban encroachment and adjacent rural land development represent political and other pressures to modify the management of watershed resources. Of particular concern is the trend to development of subdivisions in rural areas adjacent to the watersheds. The threats are less imminent on the Peninsula Watershed, where adjacent communities are more built out and will be experiencing slow growth over the next 15 to 20 years. On the Alameda Watershed, the adjacent communities of Hayward, Fremont, and Milpitas are moving closer to watershed lands and will be experiencing higher than average growth over the next two decades. [A demographic and employment profile of adjacent communities on both watersheds is provided in Technical Memorandum No. 2.]

Real estate development and population growth in adjacent communities are beyond the control of the Water Department, but carry the potential for increasing operations and maintenance costs as development edges closer and closer to the watershed. There are specific concerns about zoning density in Alameda County and potential sale to a developer of a large parcel adjacent to the watershed. Impacts potentially produced by urban encroachment and rural land development include the following events that have possible future cost implications:

- Erosion and sedimentation;
- Use of herbicides and fertilizers by homeowners;
- Airborne particles caused by barbecuing and wood burning;
- Undesirable and uncontrolled access to watershed;
- Increased use of land for dumping, hunting and other damaging activities;
- Increased danger of fire; and
- Non-point source contamination

Since urban and rural development can contribute nearly every major pollutant potentially affecting water quality, responding to threats of greater urban encroachment is of paramount concern.[4]

Land Acquisition and Sales

The Department expressed an interest in determining whether to purchase some land, in order to provide further protection to the water supply in specific locations. Conversely, it would be desirable to determine the feasibility of selling or swapping some land, particularly specific scattered parcels on the Alameda Watershed that are outside of the main watershed land area, some rights-of-way parcels, and miscellaneous parcels like the Niles Reservoir.

Watershed Protection

Watershed protection includes an array of management and control functions that include fire management, flood control, hazardous materials management, sediment control, erosion control, security and law enforcement. This includes the "policing" and patrolling of watershed lands by Department personnel, controlling access and continually monitoring for any degradation caused by land uses.

Risk Management

The Department is self-insured and covers the risks caused by the Department. All lessees and many revenue-generating land use permit holders are required to carry insurance to cover their activities. In addition, annually there are nearly 1,600 non-revenue permits issued by the Water Department to permit holders that include cities, school districts, religious and social service institutions and agencies, utilities and private commercial and development operations. Such permits are for a number of uses that include permits for installing equipment, excavations, construction, right-of-ways, parking, storage, and operation of commercial facilities. These types of non-revenue permits require insurance to cover risks and potential liabilities. Risks for which the Department requires insurance include personal injury, increased fire hazards, and incidents with equipment and vehicles.

Access to Watershed Lands

Administration and issuance of various permits is part of the general watershed management function. In addition to those described previously, types of permits include entry and "day" permits. Several potential land use alternatives raise basic questions about the personnel effort and costs needed to control and monitor access. Assessment is needed of the potential for increased revenues versus the costs of managing access.

Fire Management vs. Fuel Management

Management of both human-induced and naturally-occurring fires is an important watershed operation and maintenance function, with costs that are to some extent tied to issues of land use and access. On both watersheds, mechanical fire control measures are used, e.g. fire breaks, fire road maintenance, etc. With the heavy forestation on the Peninsula Watershed, fire management currently is limited to mechanical practices. On the Alameda Watershed, grazing and other fuel management techniques are used. General economic considerations include assessing the revenue benefits of grazing versus the costs and potential liabilities of not grazing. Grazing is discussed at length in a later section.

Golf Courses

There are two golf course leases -- one on each watershed -- which represent significant revenues to the Water Department. However, it is uncertain what changes should be instituted in these agreements as the leases terminate and are renegotiated. Crystal Springs Golf Course (which is discussed in detail under the section on Peninsula land uses) had a 40-year lease. The Department considers that to be too long a period for a fixed set of terms and conditions, but acknowledges that the lease terms must be long enough to support private financing for capital improvements undertaken by the lessees. The current leases call for many improvements which the Department feels were not adequately addressed in the latter years of the lease periods. Economic issues center around lease management strategies to be implemented when the current leases expire.

Other Recreational Uses

Recreational uses of watershed lands are perceived by the Department as labor-intensive, difficult to deal with and controversial, at best, when compared to other types of operations. Whatever the cost structures are, recreation is essentially a political issue that must be examined from management and economic perspectives in order to make viable decisions about the introduction of new or increased recreational access or services. This is particularly true with current pressures to create access and opportunities for water recreation, mountain biking, picnicking, and other activities not currently available on the watersheds. The Department will need to make management and fiscal decisions about whether to undertake a particular recreational activity, and who will manage and operate it.

Ecological and Environmental Constraints to Land Uses

There are a number of potential cost elements that relate to ecological and environmental issues, such as biodiversity on the watersheds, protection of riparian zones, and other concerns that can affect the viability of an operation by placing restrictions on uses. An example is the cost of proposed U.S. EPA regulations designed to protect riparian zones that would disallow use of some areas and require them to be fenced off. It is expected that the Department will not be able to allow grazing in such areas, which would negatively impact the Department's management of grazing land, generate additional costs for fencing and other aspects of implementing programs, and cause loss of revenue from reductions in the amount of land dedicated to grazing.

PENINSULA WATERSHED LAND USES AND MANAGEMENT

On the Peninsula Watershed, there are a number of uses that have been conducted for many years, including a fish and game refuge, an extensive trail system for hiking, bicycling, and equestrian uses, a shooting range, a golf course and special controlled-access activity centers (Pulgas Water Temple and Filoli Center). There has been a request for fishing on the Lower Crystal Springs Reservoir, and a segment of the proposed Bay Area Ridge Trail is being considered for development within the watershed. Special interest groups have expressed a desire for greater access and for some currently prohibited activities to be allowed, such as mountain biking and access to the reservoirs. The sections which follow highlight issues that have potentially significant economic ramifications.

Peninsula Golf Courses

The Crystal Springs Golf Course is operated by a private operator on a 40-year lease that expires in 1995. In FY ending June 30, 1992, the Water Department received nearly $300,000 in revenues from this golf course. The greatest concern about the golf course is the impact of run-off on water quality. Crystal Springs gets some water from the Department and some from its own ground wells. During the drought, there was dramatically increased political sensitivity over the large amounts of water used by golf courses.

Although Crystal Springs Golf course is open to the public, it does not charge low-cost municipal rates and San Mateo County would like to have a municipal golf course so that greens fees can be lower. Further, there is a great unmet demand for golf courses in San Mateo County and there is significant pressure for development of additional facilities. To address this demand, San Mateo County proposed to secure the Crystal Springs Golf Course lease and expand the course to another 18 holes. An EIR for such a proposition is on hold until the watershed management plans are completed. San Mateo has another golf course proposal for land at the southern end of the Peninsula Watershed owned by the SFWD.

The alternative for the City of San Francisco to operate the Crystal Springs Golf Course, rather than leasing it out was raised as an issue for exploration in the management plan and economic analysis. It is important to note that the City, not the San Francisco Water Department, owns all land under jurisdiction of the PUC. In reality, if the City wanted to operate the golf course, it would be a political decision that could be executed through a jurisdictional transfer of authority to the Recreation and Parks Department.

Peninsula Trails

San Mateo County manages the Peninsula trail system and the Water Department gets no revenues from the County for this land use.

There are two types of trails on the Peninsula. One type is open to the public through San Mateo County which has easements to use the trails. These are watershed fringe trails that are very heavily used. Access is not controlled and there are no fees. The other type of trail on the Peninsula Watershed has restricted access, open only to groups. These trails are operated by the Water Department and a permit is required each time they are used. Groups using trails for hiking or equestrian activities must be established, and chartered groups must carry $1 million in liability insurance. The groups must apply for permits 30 days in advance of intended use.

Bicycles are allowed on most, but not all of the Peninsula's open public trials. Off-trail use is not allowed; dirt and mountain bikes are restricted to trails. No motorized vehicles are permitted.

Generally, equestrians are limited to designated equestrian trails. Equestrian permits are available to groups of 10 to 25, with a fee of $5 per person. On the Peninsula side, individual equestrian permits can be obtained for $100 per year per person; each permit holder is allowed 10 guest passes per year. There is no horse boarding on watershed lands, although there are several permits for grazing and stabling horses on Department-owned land adjacent to the watershed.

Scenic Easements

The Golden Gate National Recreation Area (GGNRA) has scenic easements over property of the Peninsula Watershed, where it is designed as the trustee for the U.S. Department of the Interior. The scenic easements were negotiated when I-280 was constructed. There are two different agreements in the easements – a scenic easement and a scenic and recreation easement. The easements cover 23,000 acres of land and will exist in perpetuity. The City/County of San Francisco owns the property for the sole use of water production and storage; GGRNA is deeded the easements. If the property were

to be sold, the easements would have to be honored. The Water Development must pay taxes on the land under easement.

ALAMEDA WATERSHED LAND USES AND MANAGEMENT

The Alameda Watershed is larger than the Peninsula Watershed and has more types of uses, less protection form encroaching land development and more risks from existing land uses. At its southeastern edge, there are approximately 76,000 acres of privately-owned land inside the watershed. Roughly 30,000 acres within the watershed are devoted to grazing. There are also rock quarries and two 18-hole golf courses, all of which generate considerable revenues for the Department.

Grazing

Nearly 30,000 acres on the Alameda Watershed are currently dedicated to grazing. The number one benefit of grazing is fuel control for fire protection; the other benefit is revenue generation. Grazing practices currently are being examined and are expected to be a part of the Watershed Management Plan.

The basis for grazing leases has been an oral bid, with the highest bidder getting the lease. This approach has proved to be problematic because high bidders did not necessarily have the proper credentials and qualifications, and many overgrazed the land to support their high-cost leases. Some did not make their payments and the City had to resort to legal means to get them off the land. Currently, modifications to the grazing leases are being considered with the intention of providing better management and controls for land use, including requiring lessees to reduce the number of cattle on the land. A process is being implemented for screening prospective lessees to determine their financial wherewithal and their track-records.

Current annual lease prices for grazing land range from $2.50 to $31.50 per acre, per annum. The Department's current average lease per acre per year is $14.10. Some of the leases are old (and therefore undervalued), but in many cases, the quality of land is at the lower end of the spectrum because of brush and the steepness of some of the terrain. Even if some of the older leases were renegotiated, the overall average would probably not exceed $15 per acre. This is compared to average lease rates per acre charged by private ranchers of $15 to $20 per acre.

Negative effects of grazing include:

- Water quality impacts from micro-organisms
- Potential erosion problems;
- Fecal material in areas also used for recreation;
- Costs incurred when livestock get on the roads;
- Liability problems;

- Fence maintenance;
- Maintenance of a water supply for livestock;
- Loss of species diversity.

In many cases, these costs are covered by the lessee; others must be borne by the Department.

Nurseries

Initially, nurseries were allowed because the Department had open land and free water and this use was a way to make money. The Department allowed tree farms and row crops, including walnuts and strawberries, then they went to higher revenue producing crops. Now, urbanization has produced more profits from house plants and landscape products. This raises the issue of whether the Department should revise leases to capture a percentage of nurseries' gross revenues. In addition to their revenue-producing function, nurseries also serve aesthetic purposes, e.g., screening quarries from view and softening the visual effects of the areas being mined.

Nurseries require quite a bit of water for maintenance of plants and the leases were structured at low cost to the lessees. Leasing arrangements, many for as long as 10 years, have provided free water as an incentive. The nurseries overused the water until the drought gave the Department the leverage to ration water, giving each nursery an allotment. All nurseries have installed drip systems or water by hand to conserve water. All new nursery leases will cover payment pay for water.

The negative effects of nursery uses include creating impermeable surfaces, compaction of soil, and chemical and pesticides run-off, potentially resulting in ground and surface water contamination. However, the water supply and ground water impacted by runoff from nurseries on the Alameda Watershed belongs to the Alameda Water District, not SFWD. Costs to SFWD include assessment of potential contamination form fertilizers and herbicides used by the nurseries. For about a year, the Department has been requiring that all growers provide a monthly chemical report to the County Agricultural Commissioners, who send it to the State. The reports are reviewed by the Department's water quality staff.

Quarries

Quarries have been operating on the watershed since the 1950's, with increased operations since the 1970's. There are two major leases for quarries, with all of their current operations confined to south of I-680. Quarry leases include royalties to the Department as a portion of mining revenues. Royalty rates were renegotiated in January 1993; the rates are per ton of rock extracted. At the time this memorandum was developed, specific information was not available on the new rates or the amounts extracted. The mining leases are to:

> **Mission Valley Rock** has a total of 250 acres under lease, with revenues totaling $866,100 (plus $565 for taxes) in 1993-1994. Mission Valley has a valid lease and permit for 70 acres north of I-680. The company wants to amend the lease

and permit to allow for mining on an additional 170-acre parcel. The Water Department wants to develop the Management Plans before going ahead with more mining in the area.

Santa Clara Sand and Gravel Company runs the Lone Star Quarry, which has 300 acres. The company paid rent and tax reimbursements of $387,300 to the Water Department in 1993-1994.

Apperson Ridge is a proposed quarry on private, adjacent land that drains into the watershed, but is not owned by SFWD. The surface mining permit for this project has been approved by Alameda County. When mining operations are activated, there will be 1,000 truck trips per day to the quarry. A road will be built on an easement the landowner obtained in a transaction, in which the Water Department obtained 40 acres of land in exchange for an unspecified easement. Erosion, air quality from traffic emissions, and other potential problems bearing economic consequences are possible form this enterprise.

Chevron Pipeline

A fuel pipeline owned by Chevron, U.S.A., traverses the northern sector of the Alameda Watershed in a linear alignment with a cumulative total of 16 acres of land area. Chevron's pipeline lease expired in May 1985 and they have since been on a month-to-month basis. Several SFWD departments are looking at the lease, since the amount paid by Chevron ($8,300 annually for a total of 16 acres) is considered by the Department to be totally inadequate. In addition to a higher lease price, the Department is trying to negotiate better resolution of concerns regarding hazardous materials and engineering issues.

The pipeline crosses the Calaveras Fault five times and SFWD is talking with Chevron about relocating it away from the fault, even though where it crosses the fault is not in the prime watershed area. If there was a spill, there would be a major impact on the Alameda Water District water supply and it would impact the ground water.

Other Uses

As of fiscal year 1992-1993, there were installations in the watershed engaged in testing of explosives, ammunition, and radar satelites which are currently being phased out. All evidence of these facilities are to be eliminated and the land returned to its original condition. The only exception is retention of a structure the Department will use for storage. Termination of these leases will result in loss of at least $175,000 in annual revenues.

There are two proposals on the Alameda side for a hydro plant. One was on the Calaveras Dam as part of the water treatment system; this proposal was by another proponent. A former proposal was at the Calaveras Reservoir. The Department is not actively pursuing either proposal at this time.

Queries have been received by the Water Department about other uses not currently allowed on the watershed, including water recreation, using abandoned quarries for recreation, and leasing of telecommunications sites.

Sunol Golf Courses

The Sunol Golf Course is actually two 18-hole courses under one lease. There are seven years remaining in the lease, with an option for an additional seven for a potential total of 14 more years. Revenues generated by the Sunol Golf Courses for 1993-1994 were $457,600.

Some non-potable water has been supplied to the Sunol Golf Course operator by the Water Department. Additional irrigation water is obtained from pumping out Mission Valley's quarry pits. No groundwater is used to irrigate the golf course. It is unknown whether golf course lease revenues provide adequate compensation for the water provided by the Department. Because no rate has been established for non-potable water, to date, the Department has levied no charges.

Alameda Watershed Trails

Trails on the Alameda Watershed are pretty rugged, hot and dry, so the intensity of use is low in the summer. Most use occurs in the Spring. Trails are limited to those on lands leased to the East Bay Regional Park District (EBRPD), which has more than 3,600 acres under lease. EBRPD uses the land for grazing and recreation purposes and operated a 23-mile trail through the property. The trail is open to drop-in use and there are no restrictions on access. The two leases held by EBRPD pay the Department about $63,000 a year; these are currently being negotiated.

There are no equestrian uses on trails on the Alameda Watershed, although there have been three proposals.

Water-Related Recreation

On the Alameda Watershed, the Department is looking at using quarry sites for water supply storage when mining is played out. The Department is considering the possibility that some of these future reservoirs could be designated for water sports and water recreation. There are no current Department plans to convert any existing reservoirs to water recreation uses, however they are interested in the management plan examining these issues and testing some scenarios.

SUMMARY OF ECONOMIC AND LAND USE ISSUES

In the evaluation of alternative land uses, economics will be one factor among many in determining the overall viability of an option. After watershed management and

operational goals and priorities are met, it is assumed that relative costs and benefits of specific policies and actions could affect decisions about whether and how an alternative would be carried out. Because of the manner in which accounting is done in the Department, it is recommended that some means should be established for tracking and accounting for use of funds to manage the watersheds. In addition, there should be some consideration of ideas for upgrading the revenue-generating potential of existing uses and evaluating additional activities that might be implemented. Another analytical strategy would be to look at the effects of implementing selected new uses and project the likely cost impacts as part of the evaluation of whether a particular alternative use will return benefits at least commensurate with its costs.

What follows is a list of watershed management issues that have economic implications. Table 8 displays the benefits, disadvantages, and management issues for current and potential land uses.

Managing Access Issues:

- Methods and costs of restricting and controlling access and minimizing trespassing;
- Method by which access to watershed is structured for new alternative land uses, particularly recreation, e.g. open, controlled, fee-based, permitted;
- Who/what entity is responsible for managing access and under what circumstances.
- Extent to which alternative land uses could generate permit revenues sufficient to justify the additional resources required to permit and monitor.

Watershed Protection Issues

- Whether additional land uses that increase public access (e.g. recreation) would require changes in policies regarding risk management and liability coverage;
- Amount by which the costs of achieving adequate liability coverage (internally or otherwise) would increase with changes in uses;

Fire Management Issues:

- Need to project increased probability of fire risk that accompanies increased public access;
- Costs associated with additional fire management activities, including personnel expenses and cost of vegetation management methods;

- Resolution of any questions about continuation of grazing as a fire management technique, including whether the total acreage devoted to grazing will be reduced to comply with pending U.S. EPA regulations.

Urban and Rural Land Development:

- Administrative and potential legal costs of promoting protective land use controls or legislation in the jurisdictions containing watershed lands;
- Need to have defensible data with which to deflect development encroachment near the watersheds
- Methods of fire prevention and fuel management on adjacent private lands.

Land Acquisition:

- Whether any proposed alternative land uses or location of allowed uses would result in a need to acquire additional land to protect water supply or provide an alternative location for a specified activity.
- Whether there should be a trust fund for watershed land acquisition.
- Whether there would be any advantage in swapping specific parcels, either for the revenue that would be generated or to procure land adjacent to watershed that represents an imminent or future threat to the watershed;
- Determination of whether specific parcels not in the watershed should be retained or divested of, in consideration of its importance to water production storage or protection, its net revenue generation capacity, property tax costs, risk of potential liabilities, and cost to manage leasing or permitting arrangements.

Golf Courses:

- Need to determine rational and flexible terms and conditions for future golf course leases that incorporate appropriate periodic monitoring and financial provisions of financial status
- Consideration of operational alternatives, including potential for the City of San Francisco to operate golf courses rather than lease them out.

Recreation:

- Terms and conditions to be incorporated into future recreational lease agreements to ensure that they are flexible and renegotiable.

- Identification of actions, such as stepping up water purification, which respond to new or more intensive recreation uses including increasing fire protection, modifying vegetation and making fire breaks.
- Degree to which costs of amenities like wider, better trails, and the costs of managing an expanded recreation program would have to be borne by the Department's customers through water rates.
- Selection of fiscal and fee-based strategies that would allow a controlled use, say picnicking, to offset costs of an open use like the public trail system.
- Determination of specific costs and benefits that would be derived from recreational options.
- Need for a planning strategy for water recreation alternatives that would incorporate such issues as cost of additional water treatment and water quality protection in evaluation of future proposals for such uses.

Agricultural and Non-Agricultural Leases:

- Use of the new grazing lease that has been drafted, along with modified contracting procedures that ensure proper stewardship of the land.
- Modification of lease terms and conditions to include water charges to all lease holders.
- Review of current economics of nursery operators to evaluate option to revise leases to include a percentage of gross revenues
- Consideration of need for more administrative resources devoted to lease pricing, negotiations, and monitoring
- In light of potential liability from problems with the Chevron Pipeline, the need to examine potential costs of liabilities and other expenditures stemming from an accident; increase revenues in renegotiated lease
- Determination of how capital improvement costs and maintenance could be charged to a lessee or developer so the Department would not have to pay for land use development out of pocket.
- Determination of how to effectively assess whether a lessee or developer can afford the capital, operational and maintenance costs of a proposed project.

Ecological and Environmental Issues:

- Need to quantify increased costs of complying with environmental regulations when uses will contribute to degradation of environment or water quality.
- Consideration of increased risks of bacteria and pathogens in water supply resulting from animal and human contact and related costs for increased water treatment.
- Economic tradeoffs between increased treatment (with the attendant health risks), compared to protecting the water supply from degrading influences.

Note: This technical memorandum was prepared during the course of the watershed management planning process. The information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some specific issues noted in this memorandum may have been further refined through the planning process. These refinements are reflected in the Watershed Management Plans.

END NOTES

1. Contacts in the San Francisco Water Department:

   Edward Stewart, Watershed Resources Manager
   Jerry Romani, Real Property Manager
   George Lester, Urban Forester, Alameda/Peninsula
   Tim Koopman, Agricultural Land Agent, Alameda
   Joe Naras, Watershed Management, Peninsula
   Mark Mueller, Watershed Management
   K.Y. Chiu, Civil Engineer, Land Engineering Division

2. San Francisco Water Department, Final Budget, 1992-93, Budget Detail dated November 6, 1992.

3. Public Utilities Commission, San Francisco Water Department, Agriculture and Land Division, 1991-92 Annual Report (for Fiscal Year Ending June 30, 1992).

4. American Water Works Association Research Foundation, Effective Watershed Management for Surface Water Supplies, 1991

TABLE 8.

LAND USE BENEFITS, DISADVANTAGES, AND MANAGEMENT ISSUES

LAND USE	WS	BENEFITS	NEGATIVES	MGMT ISSUES
GOLF COURSES	A/P	Serves public; high revenue generation	Chemical run-off; high-volume water use	Leases; maximizing revenues
TRAILS	A/P	Serves public	Erosion; sedimentation; unauthorized and illegal activities	Controlling access; solid waste; sanitation, increased liability; trail management; recreation area leases and permits
WATER RECREATION (BOATING, FISHING)	None	Serves public; revenue generation	Human contact resulting in bacteria and pathogens in water supply	Controlling access; permits and fees; solid waste and sanitation; liability; security and safety.
OTHER RECREATION (PICNICING, SHOOTING RANGE, HUNTING)	P	Serves public	Erosion, sedimentation, unauthorized and illegal activities	Controlling access; solid waste; sanitation, increased liability;
GRAZING	A	Fire management; revenue generation	Erosion and sedimentation; bacteria and pathogens; aesthetic disadvantages when paired with recreation activities; increased need for fencing.	Leases terms and conditions; maximizing revenues; range management; pest management; management of noxious vegetation
NURSERIES	A	Aesthetic asset near quarries; revenue generation	Erosion and sedimentation; chemical/pesticide run-off	Leases, including royalty arrangements; potential expansion of current leased operations; quarry on adjacent property in the hydrologic watershed.

LAND USE	WS	BENEFITS	NEGATIVES	MGMT ISSUES
QUARRIES	A	High revenue generation; potential reuse of abandoned quarries for water storage and/or water recreation	Erosion and sedimentation; truck traffic loads during periods of heavy operation; possible visual effects.	Lease management; mitigating effects of adjacent quarry at Apperson Ridge; maximizing revenues
PIPELINE	A	Revenue generation	Risk of spill or leakage with significant impact on water supply and environment; a risk of major disaster in earthquakes; unknown potential liability if water supply contaminated; clean-up costs	Lease negotiation; risk management; lease monitoring.
SPECIAL EVENTS AND TOURS	P	Serves public, educational, research benefits; revenue generation	None apparent	Permits and fees; manging and monitoring arrangements for events; parking and access management
COMMERCIAL OPERATIONS	A/P	Revenue generation	Phasing out on Alameda Watershed; unknown which (if any) of the commercial operations (quarry, adjacent landfill, adjacent cemetery) on Peninsula might affect watershed	Lease management; determination of viability of existing operations.

SAN FRANCISCO WATERSHED MANAGEMENT PLANS

SAN FRANCISCO WATER DEPARTMENT: LAND DIVISION REVENUES (LEASES & PERMITS)

TABLE 9. FISCAL YEAR JULY 1, 1993 - JUNE 30, 1994

LOCATION & AGREEMENT NO.	PARCEL NUMBER	ACREAGE	TYPE OF USE AND REVENUE: GRAZING	NURSERY/ AGRI USE/ STABLES	MINING	RECREA-TION	COMMER-CIAL OPS	PARKING/ LANDSCAPE/ ACCESS	UTILITIES/ COMMUN/ PIPELINES	REIMBURSABLE TAXES	OTHER PERMITTED USES	TOTAL REVENUES	LESSEE/COMMENTS
WITHIN SFWD's ALAMEDA WATERSHED OWNERSHIP													
AGRICULTURAL LEASES													
L3562SC	51	67	$1,072									$1,072	Bohan
L3446AL	46	1910	$14,325									$14,325	Fields Livestock
L3370-A AL	Part of 65	6		$2,400								$2,400	Dell
L3537 AL	43	1907				$15,717						$15,717	EBRPD
3670 AL/SC	55	2100	$7,200									$7,200	Fields
L3560 AL	42	715	$25,204									$25,204	Garcia
L3623 AL	20	290	$1,776									$1,776	Mendoza
L3666 AL	Part of 65	173		$12,975								$12,975	Pacific Nurseries/MV Rock
L3427 AL	59	63		$12,311								$12,311	Naka Nursery
L3419 AL/SC	47	9880	$68,420									$68,420	Naka Nursery
L3463 AL	1	340	$0									$0	Olney
L3563 AL	34	1200	$0									$0	Olney
L3621 AL	35	4405	$1,377									$1,377	Olney
L3199 AL	18	23		$9,379								$9,379	Pacific Nurseries
L3371-A AL	19	15		$5,580								$5,580	Pacific Nurseries
L3428 AL	57	34		$8,458								$8,458	Pacific Nurseries
L3467-A AL	28	167		$24,221								$24,221	Pacific Nurseries
L3367-A AL	37	1335	$26,700									$26,700	Pombo
L3443 AL	Part of 65	265	$6,890									$6,890	Pombo
L3444 AL	11	500	$14,250									$14,250	Pombo
L3564 AL	13	160	$3,040									$3,040	Pombo
L3622 AL	12	385	$11,935									$11,935	Pombo
L3473-A AL	31	25		$15,279								$15,279	Sunol Christmas Tree Farm
L3369-A AL	16	32	$11,267									$11,267	Ura; Two permits to lessee
L3450 AL	58	28		$27,292								$27,292	Valley Crest Tree
L3442 AL	32	750	$14,875									$14,875	Vassar
Total		**26,775**	**$208,331**	**$117,895**	**$0**	**$15,717**	**$0**	**$0**	**$0**	**$0**	**$0**	**$341,943**	
LEASES - NON-AGRICULUTRAL AND MISCELLANEOUS													
L3185 AL		16							$8,300			$8,300	Chevron pipeline
L3483-A AL	43/44	2950				$36,100				$11,169		$47,269	EBRPD
L3292 AL	Portion of 62 and 65	48								$565		$565	Mission Valley Rock
L3555-A AL	29/30	204			$866,129							$866,129	Mission Valley Rock; Terminated Yard?
L3468	48	3					$10,168					$10,168	Quantic
L3430 SC	Part of 65	317			$353,593					$27,090		$380,683	SC Sand and Gravel
L3605 SC	Part of 65	7			$5,897					$716		$6,613	SC Sand and Gravel
L3662 SC	49	50					$80,415			$447		$80,862	Loral Corporation
L2511 AL	23	280				$448,502				$9,067		$457,569	Sunol Valley Golf Course
Total		**3875**	**$0**	**$0**	**$1,225,619**	**$484,602**	**$90,583**	**$0**	**$8,300**	**$49,054**	**$0**	**$1,858,158**	
PERMITS													
P3668 AL	9	10	$300									$300	Cordtz
P3568 SC	52	480	$1,440									$1,440	Covo
P3587 SC	50	37	$555									$555	Covo
P3570 SC	53	1961	$6,618									$6,618	Fields
P3567 AL	Part of 62	64	$1,076									$1,076	Gronley
P3565 AL	7	106	$2,153									$2,153	Medeiros
P3672 AL	Part of 65/13B	2						$2,400				$2,400	MVR Service Road
P3432 AL	25	2		$557								$557	Nagata; Persimmon
P3667 AL	Sunol Yard	20		$2,000								$2,000	Pacific Nursery
P3673 AL	Part of 65	11		$3,413								$3,413	Pacific Nursery
P3511 SC	S. end Calaveras Reservoir	1					$5,675			$14		$5,689	Quantic
P3566 AL/SC	8	64	$1,280									$1,280	Sanders

SEE/COMMENTS

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P3475 SM					
P3575 SM			$1	$1	Burlingame/San Mateo 4-H Club
TAL WITHIN PENINSULA WATERSHED			$1	$333,287	
TSIDE OF SFWD's PENINSULA WATERSHED O					
L3507 SM				$13,514	Skyline Stables

SAN FRANCISCO WATER DEPARTMENT: LAND DIVISION REVENUES (LEASES & PERMITS)

TABLE 9. FISCAL YEAR JULY 1, 1993 - JUNE 30, 1994

LOCATION & AGREEMENT NO.	PARCEL NUMBER	ACREAGE	TYPE OF USE AND REVENUE									TOTAL REVENUES	LESSEE/COMMENTS
			GRAZING	NURSERY/ AGRI USE/ STABLES	MINING	RECREA- TION	COMMER- CIAL OPS	PARKING/ LANDSCAPE/ ACCESS	UTILITIES/ COMMUN/ PIPELINES	REIMBURSABLE TAXES	OTHER PERMITTED USES		
P1621-6 SM									$150			$150	R/W to install telephone poles
L3543-C SM		4				$30,080				$4,983		$35,063	El Camino Driving Range
L3618 SM		0.5		$19,490						$1,457		$20,947	
L2702 SM		33				$15,558				$988		$16,546	Skeet/trap shooting
P3550 SM		29	$3,428							$1,178		$4,606	
P3213-A SM	Part of 31	8	$1,656							$70		$1,726	McClenahan
Multi Permits		3								$1,884		$1,884	City of Palo Alto
Multi Permits		3								$541		$541	Redwood City
L3548-A SM		1		$12,387						$375		$12,762	
P3075A SM		1								$154		$154	
P2796		1							$5,200			$5,200	PG&E gas main
P1655 SM		4							$4,721	$228		$4,949	
P2869 SF									$600			$600	
Total		**101**	**$5,084**	**$43,877**	**$0**	**$45,638**	**$0**	**$0**	**$10,671**	**$13,372**	**$0**	**$118,642**	
TOTAL OUTSIDE PENINSULA WATERSHED		**307**	**$5,084**	**$43,877**	**$0**	**$377,604**	**$0**	**$0**	**$11,771**	**$13,592**	**$1**	**$451,929**	
OTHER/LOCATION NOT SPECIFIED													
Commercial permits							$35,109					$35,109	
Parking/Landscape/Access permits								$190,275				$190,275	
Other taxes - permits										$52,086		$52,086	
Commercial leases							$945,190					$945,190	
Parking/Landscape/Access leases								$632,330				$632,330	
Other taxes - leases										$78,703		$78,703	
Garden permits				$880								$880	
TOTAL OTHER			**$0**	**$880**	**$0**	**$0**	**$980,299**	**$822,605**	**$0**	**$130,789**	**$0**	**$1,934,573**	
TOTAL REVENUE FROM LAND USES			**$235,232**	**$176,598**	**$1,225,619**	**$885,647**	**$1,077,985**	**$825,005**	**$25,116**	**$218,654**	**$1**	**$4,669,857**	
TOTAL REVENUE PRODUCED BY WATERSHEDS			**$228,546**	**$124,465**	**$1,225,619**	**$838,185**	**$97,686**	**$2,400**	**$10,300**	**$49,782**	**$1**	**$2,576,984**	

Appendix C-8

Technical Memorandum #7
Demographic Profile of Areas Adjacent to
Peninsula and Alameda Watershed Lands
November 1993

TECHNICAL MEMORANDUM NO. 7

DATE: November 1, 1993

TO: EDAW

FROM: Pryde Roberts Carr

SUBJ: DEMOGRAPHIC PROFILE OF AREAS ADJACENT TO PENINSULA AND ALAMEDA WATERSHED LANDS

This memorandum provides demographic and employment profiles of areas adjacent to the Peninsula and Alameda Watersheds. The information presented includes only those factors that have some relevance to issues of population and employment growth, population density and other factors that provide a picture of adjacent land area outside of the watersheds.

General statistics are provided for the cities and unincorporated communities that surround the watersheds. Projections of population and employment growth are presented at the community level -- the lowest level available. More detailed demographic data covers those census tracts that actually abut or include watershed lands. Data on the number of workers employed in or near the watersheds are presented by zip code. Employment data provides an estimate of the number of individuals that comprise the "daytime population" of the areas, the dominant industry, total payroll and average annual wages per job. The combined total of resident population and employment population provides a more accurate estimate of the number of individuals who might utilize the watershed for various purposes.

PENINSULA WATERSHED

Portions of 20 cities and unincorporated communities in San Mateo County abut the Peninsula Watershed, as shown in Exhibit A:

- Belmont
- Burlingame
- Devonshire
- Emerald Lake
- El Granada
- Half Moon Bay
- Hillsborough

Kings Mountain
Millbrae
Miramar
Montara
Moss Beach
Pacifica
Palomar Park
Princeton-by-the-Sea
San Bruno
San Carlos
Sky Londa
The Highlands
Woodside

In 1990, the total population of these communities was approximately 211,140. This population was in 82,550 households with an overall median household income of $87,960, ranging from $51,589 in San Bruno to nearly $197,607 in Hillsborough.

By the year 2010, population and household growth in the adjacent communities is expected to increase to 240,700 and 93,970, respectively. This would be a 14 percent increase over the 20-year period between 1990 and 2010 -- a relatively slow growth rate averaging only 0.7 percent annually. Household income is projected to grow somewhat more steeply, climbing to $116,700 by 2010. This would be a 33 percent increase over 20 years with an annual average growth rate of 1.7 percent. Tables 1 through 3 provide 1990 census data, plus ABAG projections through the year 2010, for population, number of households, and median income.

Drawing a more tightly configured area comprised of census tracts immediately adjacent to the Peninsula Watershed, produces a more focused profile of the adjacent land area. There are 24 census tracts in or adjacent to the watershed, with a total land area of 144.6 square miles. The watershed lands are in only three census tracts -- 6134, 6135 and 6137. These three tracts have 102.16 square miles of area and comprise 71 percent of the total land area for all 24 tracts. (See Exhibit B)

The census tracts in and adjoining the watershed had a 1990 population of 109,176, roughly half (52 percent) of the total population of the nearby communities. Individuals 18 years and older represented 79 percent of the population, with 21 percent 17 years or younger. About 84 percent of the population was White, with Asians and Pacific Islanders making up the largest ethnic minority group at about 12 percent. African-Americans, Native Americans and Other Races combined represented 4 percent of the population.

There were a total of 40,652 housing units in the 24-tract area in 1990, with a population density of 755 persons per square mile. Density varied greatly, ranging

from a low of 141 to nearly 8,000 persons per square mile. The three census tracts in the watershed had a total of 17,894 residents in 6,901 housing units that were in scattered clusters on the edges of the watershed. This area had the lowest population density, averaging 179 persons per square mile.

Table 4 presents population, housing and density data by census tract; Table 5 compiles the race/ethnicity of all census tracts in and adjacent to the watershed.

In 1990, there were 87,800 jobs in the major adjacent communities, with projections of 101,580 jobs by 2010, a 16 percent increase over 20 years (a growth rate of 0.8 percent). Table 6 provides ABAG projections for each community.

Employment in the adjacent community is primarily commercial in character. In 1990, there were an estimated 8,300 employers in the zip codes for these communities, with a total annual payroll of $3.1 billion. Average annual wages per job were $25,548. Business services, health services and eating/drinking places are the dominant industries. Table 7 provides a breakdown of employment characteristics by zip code; Exhibit C is a map showing the zip codes.

ALAMEDA WATERSHED

The Alameda Watershed is adjacent to six communities, as shown in Exhibit D:

Alameda County
Fremont
Hayward
Pleasanton
Sunol
Union City

Santa Clara County
Milpitas

In 1990, the total population of these five communities and their respective designated "spheres of influence" was 448,161. This population was in 151,269 households with an overall mean household income of $59,239, ranging from $44,075 in Hayward to $70,722 in Pleasanton.

By the year 2010, the population is expected to increase to 565,800, an increase over 20 years of 26 percent with a growth rate of 1.3 percent per year. The number of households is projected to grow to 241,720, a 59 percent increase. The growth rate for households is projected at an average of 3 percent annually from 1990 to 2010.

Household income is projected to grow at a more moderate pace, rising to $79,200 by the year 2010. This would be a 33 percent increase over 20 years with an annual average growth rate of 1.7 percent.

Tables 8, 9, and 10 provide 1990 data, plus projections through the year 2010, for population, number of households, and median income for the Alameda Watershed.

An examination of the 15 census tracts in or abutting the Alameda Watershed provides more specific detail on the characteristics of adjacent areas. There are nine census tracts in Alameda County and four in Santa Clara County. This area has a total of 776.33 square miles and contained a population in 1990 of 60,127.

The Alameda Watershed lands are in four of the census tracts -- 4351.01, 4506.01, 4507.01 (Alameda County) and 5127.98 in Santa Clara County. These four tracts have 729.32 square miles of land area (94 percent of the total). (See Exhibit E)

The census tracts in and adjoining the watershed had a 1990 population of 60,127, approximately 13 percent of the total population of the nearby communities. Individuals 18 years and older represented 73 percent of the population, with 27 percent 17 years or younger.

Whites comprised 70 percent of the population, with Asians and Pacific Islanders making up the largest ethnic minority group at 21 percent. African-Americans and Other Races each represented 4 percent of the population, while native Americans comprised less than one percent. Individuals of Hispanic ethnicity made up 11 percent of the total among all racial groups.

In 1990, there were a total of 24,578 housing units in the 15 census tracts in and adjacent to the Alameda Watershed. Population density was 88 persons per square mile. Density ranged from a low of 2 persons per square mile to over 2,600. The four census tracts in the watershed had a total of 10,118 residents and 3,432 housing units. This area had a population density of 14 persons per square mile.

Table 11 presents population, housing and density data by census tract; Table 12 compiles the race/ethnicity of all census tracts in and adjacent to the watershed.

There were 219,260 jobs in the major adjacent communities in 1990, with projections of 327,510 jobs by 2010. This would be a 58 percent increase over 20 years (a growth rate of 2.9 percent). Table 13 provides ABAG projections for job growth in each community.

In the zip codes immediately adjacent to the watershed, there are nearly 6,400 employers in a broad spectrum of industries. Dominant industries are business services which had 2,900 firms in 1990 (45 percent) and electronic equipment manufacturing with 1,818 firms (29 percent). The annual payroll of the 6,400 firms totaled $3.3 billion in 1990. Average annual wages per job were $26,697. Table 14 provides a breakdown of employment and wages by zip code; Exhibit F is a map of the zip codes.

Note: This technical memorandum was prepared during the course of the watershed management planning process. The information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some specific issues noted in this memorandum may have been further refined through the planning process. These refinements are reflected in the Watershed Management Plans.

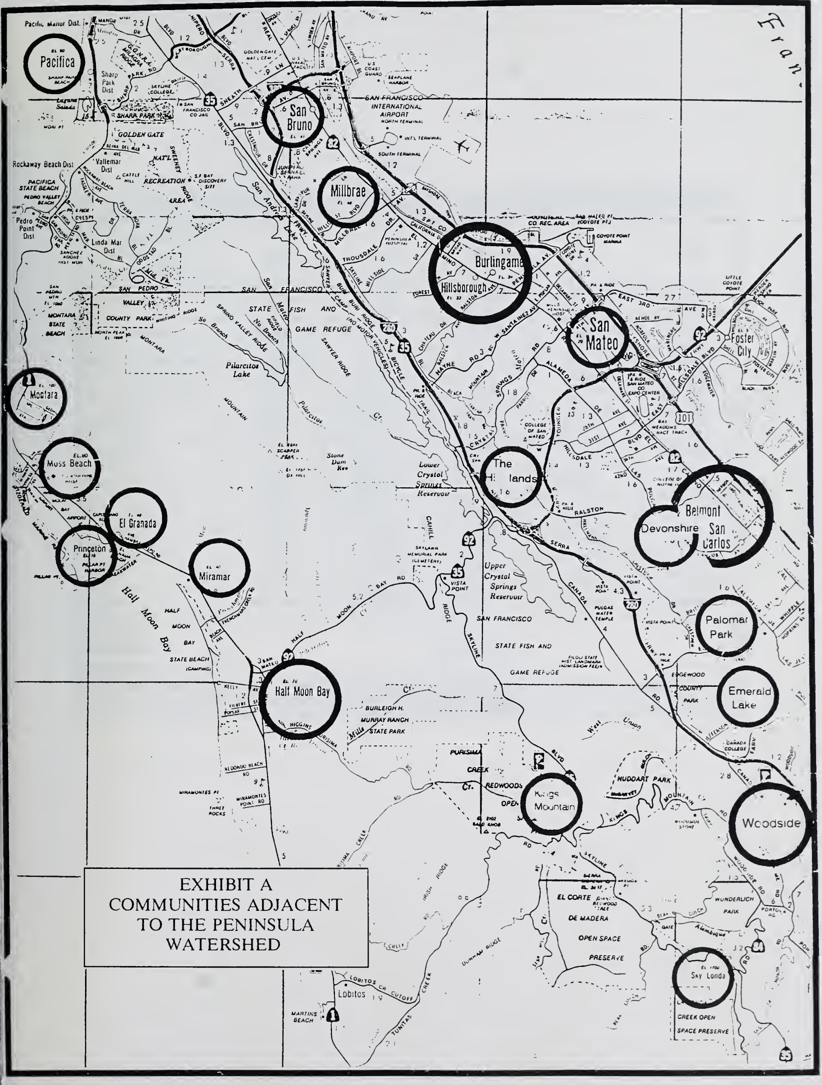


EXHIBIT A
COMMUNITIES ADJACENT
TO THE PENINSULA
WATERSHED

TABLE 1.

PENINSULA WATERSHED: POPULATION PROJECTIONS FOR ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	**1990**	**1995**	**2000**	**2005**	**2010**
BELMONT	24,641	25,200	25,700	25,600	25,500
BURLINGAME	26,701	27,400	28,000	28,500	28,300
HALF MOON BAY	8,886	10,200	11,800	13,200	14,900
HILLSBOROUGH	10,715	10,700	10,800	10,800	10,800
MILLBRAE	20,476	20,900	21,300	21,400	21,300
PACIFICA	37,670	39,700	39,700	40,200	40,700
SAN BRUNO	38,665	39,900	40,300	40,400	40,400
SAN CARLOS	27,619	28,400	28,000	25,600	29,700
WOODSIDE	5,242	5,400	5,900	6,100	6,200
OTHER	10,525	11,200	15,600	19,300	22,900
TOTAL	**211,140**	**218,400**	**228,400**	**235,100**	**240,700**
PERCENT INCREASE 1990-2010	**14 PERCENT**				

Source: Association of Bay Area Governments, Projecions 92

TABLE 2.

PENINSULA WATERSHED: NUMBER OF HOUSEHOLDS IN ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	**1990**	**1995**	**2000**	**2005**	**2010**
BELMONT	10,344	10,480	10,640	10,660	10,670
BURLINGAME	12,232	12,370	12,660	12,840	12,900
HALF MOON BAY	3,137	3,580	4,180	4,720	5,340
HILLSBOROUGH	3,639	3,740	3,820	3,880	3,900
MILLBRAE	7,947	8,040	8,180	8,260	8,310
PACIFICA	13,340	13,640	13,920	14,140	14,430
SAN BRUNO	14,661	14,780	14,990	15,030	15,180
SAN CARLOS	11,556	11,990	12,400	12,590	12,640
WOODSIDE	1,911	2,040	2,160	2,240	2,300
OTHER	3,740	3,630	5,560	6,950	8,300
TOTAL	**82,550**	**84,600**	**88,510**	**91,310**	**93,970**
PERCENT INCREASE 1990-2010	**14 PERCENT**				
Source: Association of Bay Area Governments, Projections 92					

TABLE 3.

PENINSULA WATERSHED: PROJECTIONS OF MEAN HOUSEHOLD INCOME IN ADJACENT COMMUNITIES

COMMUNITY SPHERE OF INFLUENCE	1990	1995	2000	2005	2010
BELMONT	65,962	69,700	75,600	80,900	88,600
BURLINGAME	58,283	62,600	68,000	72,100	78,100
HALF MOON BAY	66,536	69,300	77,700	84,500	91,200
HILLSBOROUGH	197,607	208,800	225,900	240,200	260,300
MILLBRAE	59,725	62,500	64,300	68,400	73,900
PACIFICA	55,640	59,000	63,200	67,600	72,800
SAN BRUNO	51,589	54,800	58,900	62,800	68,000
SAN CARLOS	71,368	76,000	81,900	87,200	94,700
WOODSIDE	180,450	180,450	205,000	218,700	235,700
OTHER	72,447	76,200	85,700	95,100	103,700
TOTAL	**$87,960**	**$92,930**	**$100,620**	**$107,750**	**$116,700**
PERCENT INCREASE 1990-2010	**33 PERCENT**				

Source: Association of Bay Area Governments, Projections 92

EXHIBIT B
CENSUS TRACTS ADJACENT TO PENINSULA WATERSHED

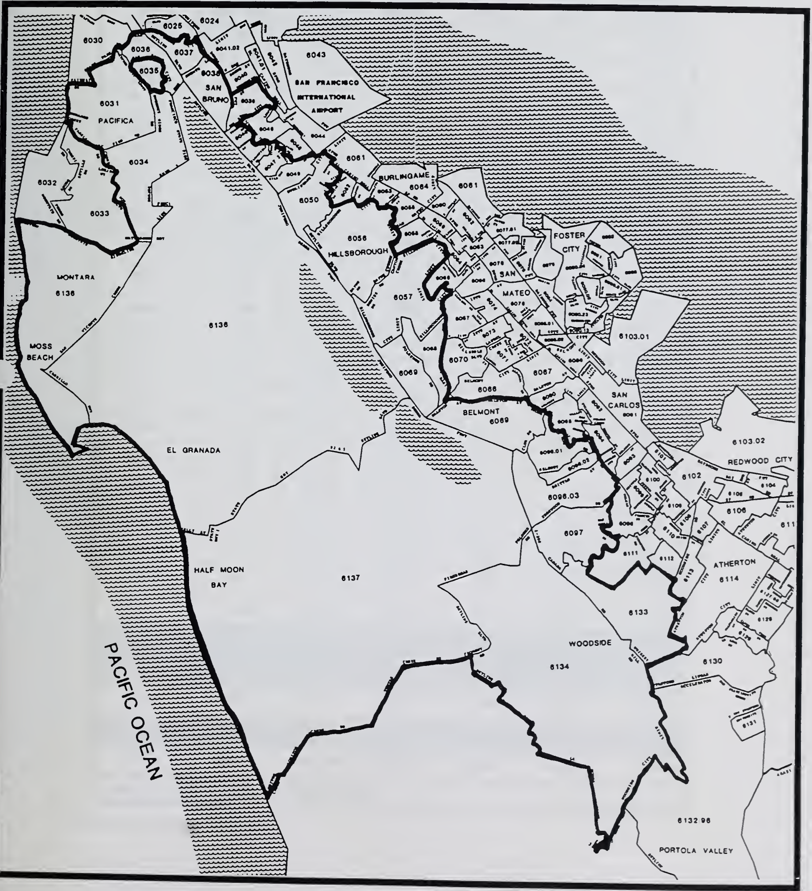


TABLE 4.

TABLE 4. PENINSULA WATERSHED: POPULATION AND HOUSING DENSITY						
SAN MATEO CENSUS TRACTS	LAND AREA (SQ. MI)	TOTAL POPULATION	POPULATION 18+ YEARS	POP. 0-17 YEARS	TOTAL HOUS. UNITS	POP. DENSITY (SQ. MI.)
6031	3.33	2,995	2,245	710	1,114	888
6034	3.69	6,160	4,582	1,578	2,118	1,668
6036	0.81	5,456	4,050	1,406	1,894	6,742
6037	0.73	5,737	4,310	1,427	1,817	7,833
6038	1.12	6,944	5,754	1,190	3,282	6.223
6039	0.75	5,028	4,033	995	2,147	6,706
6046	0.52	2,670	2,134	536	967	5,153
6047	0.39	2,611	2,123	488	1,005	6.623
6049	0.58	2,947	2,469	478	1,214	5,109
6050	1.66	7,036	5,926	1,110	2,963	4.230
6056	3.32	5,352	4,193	1,159	1,938	1.612
6057	3.10	5,363	4,141	1,222	19	1.728
6068	1.16	3,003	2.431	572	1,213	2.599
6069	1.27	2,644	2,026	618	880	2.084
6089	2.38	6,293	5,374	919	3,017	2.649
6096.01	1.10	2,626	2,166	460	1,110	2,386
6096.02	0.41	1,590	1,328	262	636	3,881
6096.03	2.34	5,267	4,255	1,012	2,063	2.251
6097	2.10	3,610	2,819	791	1,364	1,719
6133	3.68	2,393	1,910	483	929	650
6134	17.55	3,436	2,761	675	1,288	196
6135	41.79	8,416	6,191	2,225	3,064	201
6136	8.01	5,557	4,081	1,476	2,061	693
6137	42.82	6,042	4,696	1,346	2,549	141
TOTAL	**144.61**	**109,176**	**86,016**	**23,138**	**40,652**	**755**
Source: 1990 Census, P.L. 94-171 File						

* Census tracts in watershed are shaded

TABLE 5.

PENINSULA WATERSHED: RACE AND ETHNICITY							
SAN MATEO CENSUS TRACTS	**TOT. POP.**	**WHITE**	**AFRI-AMER**	**NATIVE AMER.**	**ASIAN/ PAC IS.**	**OTHER RACE**	**HIS-PANIC***
TOTAL POPULATION	109,176	91,644	1,499	414	13,313	2,266	10,085
PERCENT OF TOTAL	100	84.0	1.4	0.4	12.2	2.1	9.2
Source: 1990 Census, P.L. 94-171 File							

TABLE 6.

PENINSULA WATERSHED: PROJECTIONS OF TOTAL JOBS IN ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	**1990**	**1995**	**2000**	**2005**	**2010**
BELMONT	13,260	13,210	13,880	14,850	15,420
BURLINGAME	29,230	29,300	30,900	31,240	31,290
HALF MOON BAY	2,790	3,050	3,110	3,200	3,140
HILLSBOROUGH	1,100	1,130	1,220	1,250	1,250
MILLBRAE	5,590	5,700	5,960	6,160	6,140
PACIFICA	4,130	4,450	4,750	4,950	5,040
SAN BRUNO	12,490	13,360	14,930	16,680	17,010
SAN CARLOS	16,510	16,340	16,700	17,330	18,150
WOODSIDE	940	910	970	1,020	1,050
OTHER	1,760	1,700	2,300	2,720	3,090
TOTAL	**87,800**	**89,150**	**94,720**	**99,400**	**101,580**
PERCENT INCREASE 1990-2010	**16 PERCENT**				

Source: Association of Bay Area Governments, Projections 92, Recession Update

EXHIBIT C
MAP OF ZIP CODES ADJACENT TO PENINSULA WATERSHED

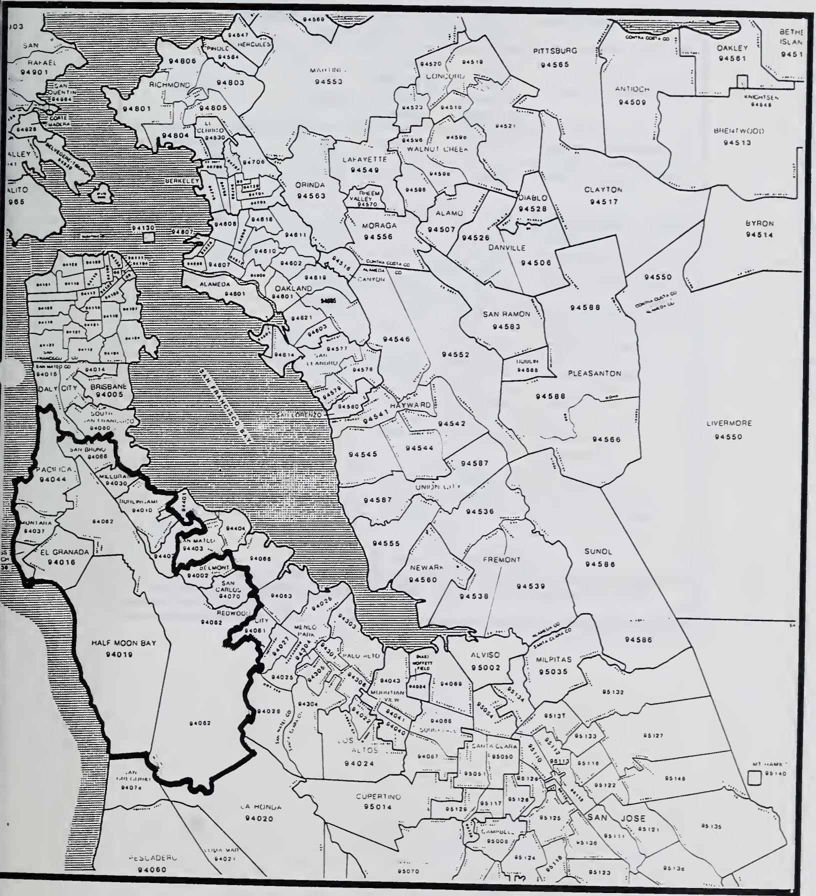


TABLE 7.

PENINSULA WATERSHED: EMPLOYMENT IN ZIPCODES ADJACENT TO WATERSHED				
ZIP CODE	TOT. FIRMS	TOTAL EST. ANN. PAYROLL ($Mil)	EST. ANN. WAGES PER JOB	MAJOR INDUSTRY
94002 Belmont	842	$332.0	$28,450	Business Services
94010 Burlingame/ Hillsborough	1,988	793.0	26,983	Eating/Drinking Places
94018 Granada	70	8.3	18,429	Eating/Drinking Places
94019 Half Moon Bay	334	56.1	22,769	Eating/Drinking Places
94030 Millbrae	498	129.6	22,303	Eating/Drinking Places
94037 Montara	43	5.0	22,400	Eating/Drinking Places
94038 Moss Beach	32	9.1	29,491	Health Services
94062 Woodside	535	73.0	23,874	Health Services
94066 San Bruno	852	290.6	22,758	Misc. Retail
94070 San Carlos	1,262	555.5	31,680	Special Trade Contractors
94404 Pacifica	937	505.9	29,403	Real Estate
94402 The Highlands and Other	925	347.1	28,037	Business Services
TOTAL	**8,318**	**$3,105.2**	**$25,548**	—

Source: Upclose California Data Book, 1993, based on 1990 Census and 1990 County Business Patterns

EXHIBIT D
COMMUNITIES ADJACENT TO THE ALAMEDA WATERSHED

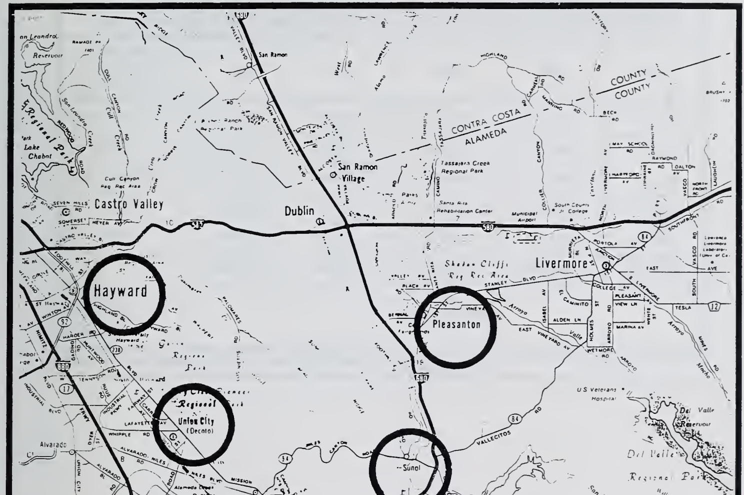


TABLE 8.

ALAMEDA WATERSHED: POPULATION PROJECTIONS FOR ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	**1990**	**1995**	**2000**	**2005**	**2010**
FREMONT	173,339	189,300	202,400	211,100	212,000
HAYWARD	118,279	120,800	128,600	137,300	142,700
PLEASANTON	52,012	60,200	65,800	74,100	79,800
UNION CITY	53,762	59,100	61,600	67,200	67,000
MILPITAS	50,769	56,500	61,900	63,100	64,300
TOTAL	**448,161**	**485,900**	**520,300**	**552,800**	**565,800**
PERCENT INCREASE 1990-2010	**26 PERCENT**				

Source: Association of Bay Area Governments, Projections 92

TABLE 9.

ALAMEDA WATERSHED: NUMBER OF HOUSEHOLDS IN ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	1990	1995	2000	2005	2010
FREMONT	60,219	65,740	70,150	72,940	73,760
HAYWARD	42,063	43,430	46,570	50,300	52,480
PLEASANTON	19,111	21,820	23,780	27,590	30,390
UNION CITY	15,718	17,290	18,520	20,510	20,790
MILPITAS	14,158	56,500	61,900	63,100	64,300
TOTAL	**151,269**	**204,780**	**220,920**	**234,440**	**241,720**
PERCENT INCREASE 1990-2010	**59 PERCENT**				

TABLE 10.

ALAMEDA WATERSHED: MEAN HOUSEHOLD INCOME IN ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	**1990**	**1995**	**2000**	**2005**	**2010**
FREMONT	61,431	65,800	72,100	76,000	81,200
HAYWARD	44,075	46,800	50,900	55,100	58,300
PLEASANTON	70,722	75,100	81,700	86,800	93,700
UNION CITY	53,629	58,900	63,600	67,400	72,500
MILPITAS	66,338	70,100	76,800	83,900	90,300
TOTAL	**$59,239**	**$63,240**	**$69,020**	**$73,840**	**$79,200**
PERCENT INCREASE 1990-2010	**33 PERCENT**				
Source: Association of Bay Area Governments, Projections 92					

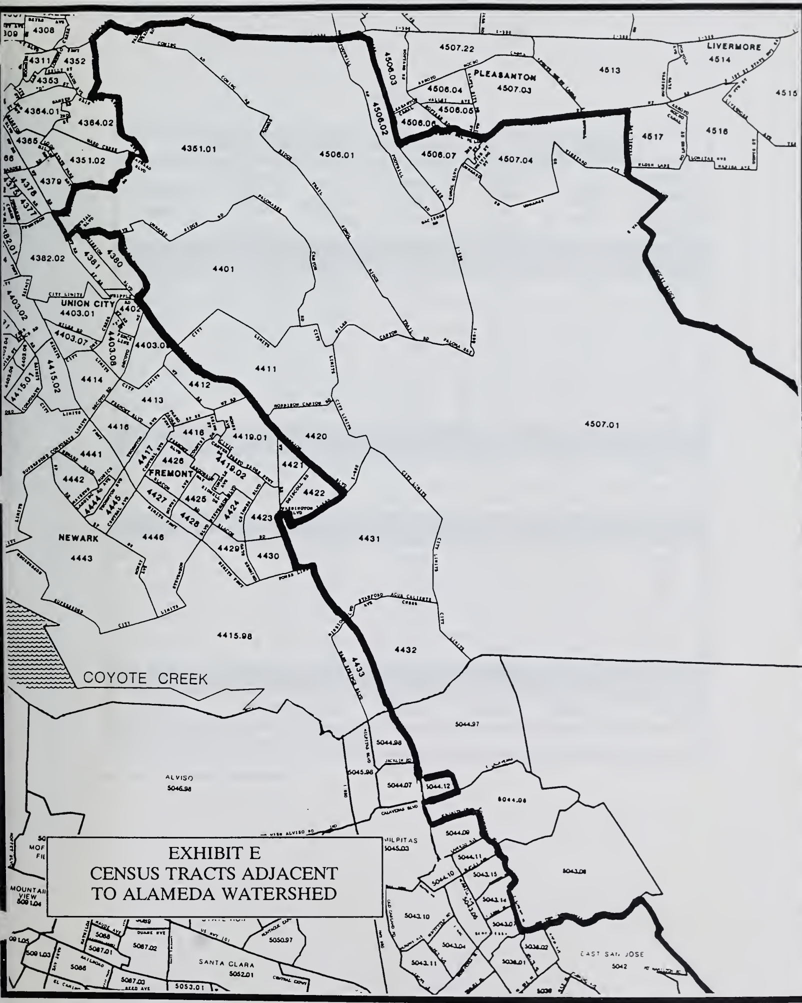


EXHIBIT E
CENSUS TRACTS ADJACENT
TO ALAMEDA WATERSHED

TABLE 11.

ALAMEDA WATERSHED: POPULATION AND HOUSING DENSITY						
CENSUS TRACTS	LAND AREA IN SQ. MILES	TOTAL POPULATION	POPULATION 18+ YEARS	POPULATION 0-17 YEARS	TOTAL HOUS. UNITS	POP. DENSITY PER SQ. MILE
ALA 4351.01	21.91	4,592	3,483	1,109	1,962	210
ALA 4431	0.66	2,329	1,818	511	731	218
ALA 4411	5.79	3,944	2,941	1,033	1,379	681
ALA 4420	3.01	2,365	1,689	676	748	786
ALA 4431	9.24	15,058	10,533	4,505	4,837	1,630
ALA 4432	5.16	2,035	1,378	657	606	395
ALA 4506.01	19.46	1,647	1,296	351	632	85
ALA 4506.02	2.38	6,217	4,744	1,473	2,515	2,607
ALA 4506.07	1.89	2,577	2,161	416	1,364	1,393
ALA 4507.01	101.79	2,968	2,225	743	1,054	29
ALA 4507.04	5.57	8,922	6,848	2,074	3,672	1,603
SC 5043.08	7.15	4,037	3,168	869	1,368	565
SC 5044.08	3.95	6,952	4,905	2,047	2,024	1,761
SC 5044.97	6.48	4,367	3,129	1,238	1,302	674
SC 5127.98	586.16	911	688	223	384	2
TOTAL	**780.60**	**68,921**	**51,024**	**17,925**	**24,578**	**88**
Source: 1990 Census, P.L. 94-171 File						

* Census tracts in watershed are shaded.

TABLE 12.

ALAMEDA WATERSHED: RACE AND ETHNICITY							
CENSUS TRACTS	**TOTAL POP.**	**WHITE**	**AFRI-AMER**	**NATIVE AMER**	**ASIAN/ PAC IS.**	**OTHER RACE**	**HISP-ANIC***
ALAMEDA COUNTY POPULATION	43,860	32,611	1,533	239	8,136	1,341	3,914
SANTA CLARA COUNTY POPULATION	16,267	9,612	716	90	4,753	1,096	2,776
TOTAL POPULATION	**60,127**	**42,223**	**2,249**	**329**	**12,889**	**2,437**	**6,690**
PERCENT OF TOTAL	100.0	70.2	3.7	0.5	21.4	4.1	11.1

Source: 1990 Census, P.L. 94-171 File

TABLE 13.

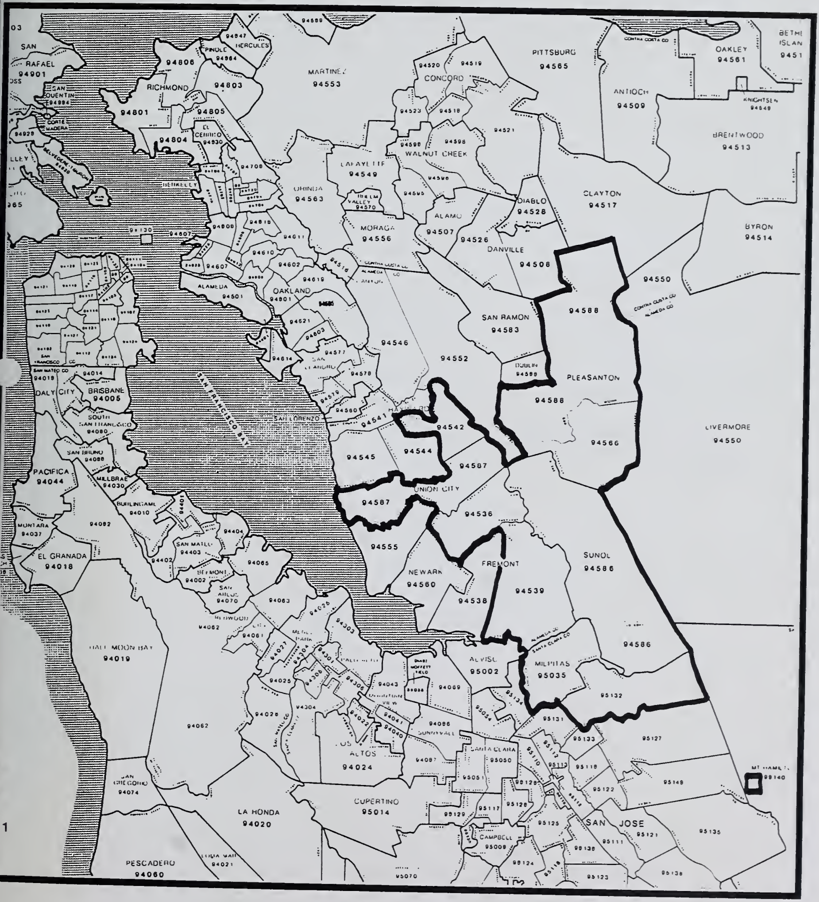
ALAMEDA WATERSHED: PROJECTIONS OF TOTAL JOBS IN ADJACENT COMMUNITIES					
COMMUNITY SPHERE OF INFLUENCE	1990	1995	2000	2005	2010
FREMONT	65,700	71,240	85,710	100,020	109,590
HAYWARD	73,400	73,370	79,340	85,940	86,950
PLEASANTON	31,930	36,520	45,480	51,230	58,350
UNION CITY	11,670	11,170	13,060	15,140	16,610
MILPITAS	36,560	36,630	42,460	53,750	56,010
TOTAL	**219,260**	**228,930**	**266,050**	**306,080**	**327,510**
PERCENT INCREASE 1990-2010	58 PERCENT				
Source: Association of Bay Area Governments, Projections 92, Recession Update					

TABLE 14.

ALAMEDA WATERSHED: EMPLOYMENT IN ZIP CODES ADJACENT TO WATERSHED				
ZIP CODE	**TOT. FIRMS**	**TOTAL EST. ANN. PAYROLL ($000)**	**EST. ANN. WAGES PER JOB**	**MAJOR INDUSTRY**
94536 Fremont	904	$266.9	$23,656	Business Services
94539 Fremont	984	190.8	25,602	Electronic/Electric Equipment
94542 Hayward	114	24.8	27,738	Special Trade Contractors
94566 Pleasanton	1,995	963.1	24,418	Business Services
94588 Pleasanton	496	190.8	25,125	Business Services
94586 Sunol	26	10.4	29,036	Amusement/ Recreation Services
94587 Union City	682	312.7	26,763	Wholesale Trade
95035 Milpitas	1,237	1,319.5	34,141	Electronic/Electric Equipment
95132 Unspecified	315	60.3	23,910	Eating/Drinking Places
95140 Unspecified	9	1.6	26,993	Special Trade Contractors
TOTAL	**6,359**	**$3,289.3**	**$26,738**	---

Source: Upclose California Data Book, 1993, based on 1990 Census and 1990 County Business Patterns

EXHIBIT F
MAP OF ZIP CODES ADJACENT TO ALAMEDA WATERSHED



Appendix C-9

Technical Memorandum #8
General Plans Review
June 1994

TECHNICAL MEMORANDUM NO. 8

GENERAL PLANS REVIEW

DATE: June 20, 1994

TO: EDAW, Inc.

FROM: E. M. Rose and Associates

SUBJECT: Review of San Francisco, Alameda, Santa Clara and San Mateo County General Plans Relating to Peninsula and Alameda Watersheds

Note: This technical memorandum was prepared during the course of the watershed management planning process. The information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some specific issues noted in this memorandum may have been further refined through the planning process. These refinements are reflected in the Watershed Management Plans.

INTRODUCTION

The purpose of this technical memorandum is to review all applicable county general plans to evaluate the significance of plans and policies that apply to San Francisco Water Department (SFWD) watershed lands in Alameda, Santa Clara and San Mateo counties. This review considers plans and land use policies for watershed lands in SFWD and other public and privately-owned lands. County master plan policies were selected for inclusion if they could potentially impact watershed management and maintenance operations, or if they allow for the subdivision and/or development of watershed lands not owned by SFWD or other public agencies. The Peninsula Base Map and Alameda Base Map show existing land uses for the watersheds.

San Francisco Master Plan

The San Francisco Master Plan was adopted in 1990. The Recreation and Open Space Element of the Master Plan, Policy 2, states: "Make open space lands already in public ownership accessible to the public for compatible recreational uses (Page I.3.4)." This general policy applies to SFWD watershed lands:

> "Public access should be provided by the SFWD to portions of its watershed lands which have high recreational value, subject to restrictions required to protect water quality and water production, rare and endangered plant and animal species, and preserve wildlife habitats, archaeological and natural resources (I.3.4)."

No other references to SFWD watershed lands have been identified in the San Francisco Master Plan.

Alameda County East County Area Plan

Proposed Development Alternatives

The Alameda County East Area encompasses 418 square miles and includes the cities of Livermore, Pleasanton, Dublin, the town of Sunol and a portion of Hayward as well as surrounding unincorporated areas. The Alameda East County Area Plan (ECAP) region includes SFWD's Alameda County land holdings. ECAP was prepared in 1993 by the Alameda County Planning Department and was adopted by the Alameda County Board of Supervisors on May 5, 1994. ECAP is unique among the county general plans reviewed in this memorandum, because it proposes a master land use plan for the East County Area and specifies 2010 and ultimately (2015) dwelling units, populations and jobs holding capacities for the East County Area.

Policy 10 0f ECAP specifies a population of 252,000, 94,700 housing units, and 151,900 jobs by the year 2010. The proposed plan proposes an almost 90 percent population increase from 1990 to 2010

The ECAP environmental review document recognizes that freeway, highway and arterial roadway capacities in the East County Area would be inadequate to meet increasing traffic demand of the proposed plan. The proposed plan specifies, for example, the development of Vallecitos Road/Highway 84 into a six lane expressway. No funding sources have been identified for this project. Generally, the existing and projected transportation capacity in the East County Area is recognized by the environmental document to be the weak link in the proposed plan.

The ECAP environmental document concludes that the Sunol area should be maintained primarily as unincorporated county land open space. All proposed alternatives protect the Sunol Valley from inclusion in the boundaries of an incorporated city and thereby from increased urbanization.

Proposed ECAP Watershed Plans and Programs

The ECAP creates a new large-parcel agricultural land zone, A-320, that applies to substantial portions of watershed lands not owned by SFWD. Program 39A states that:

> The County shall amend the zoning ordinance to create the "A-320" (Agriculture-320 acre minimum parcel size) District. This new zoning district shall generally cover the following

> areas: 1) remote lands having slopes of 50 percent and over . . . located generally south of Tesla Road . . . Vallecitos Road, and Niles Canyon Road (except lands westerly of San Antonio Reservoir, including the Sunol Valley); 2) EBRPD lands and San Francisco Water Department watershed lands located generally south of. . . Vallecitos road, and Niles Canyon Road (except lands westerly of San Antonio Reservoir, including the Sunol Valley. . . .

The small-parcel agricultural areas will remain in the A-100 zoning category which allows one dwelling unit per 100 acres. The SFWD-owned watershed lands will continue to be zoned Resource Management: Watershed Protection.

The following programs and policies could impact operations and maintenance of the Alameda Watershed:

Policies 102 and 103 relate to park and recreation facilities. Policy 102 states that "The County shall encourage public water management agencies to explore recreational opportunities on watershed lands, particularly reclaimed quarries, where recreational use would not conflict with watershed protection objectives." Policy 103 states that:

> The County shall encourage the San Francisco Water Department to provide limited public access on trail corridors through the watershed lands surrounding San Antonio and Calaveras Reservoirs, Sunol Watershed, and the Arroyo de la Laguna. The County shall work with the East Bay Regional Park District to incorporate these watershed corridors into the regional trail system, where recreational use would not conflict with watershed protection objectives [emphasis in original].

Policy 150 states that "The County shall work with the San Francisco Water Department to develop a land use and reclamation plan for San Francisco Water Department-owned land in the Sunol Valley. The plan shall ensure the compatibility of the quarries with the Sunol Community during active mining and following reclamation. Opportunities for habitat preservation and enhancement and recreational uses should be explored in conjunction with reclaimed uses [emphasis in original]."

Policy 104 could have important implications for the Alameda Watershed in protecting against negative impacts on watershed lands of the proposed Apperson Ridge Quarry. Policy 104 states that:

> The County shall designate an area outside of the San Francisco Water Department lands that extends to the limit of the watershed boundary as "Resource Management". Within this area the County shall encourage land use activities to adhere to management guidelines developed for the protection of watershed lands and shall ensure that subdivisions of lands or quarry operations and reclamation plans within this designation shall be approved only where such subdivisions or quarry operations would not adversely affect the watershed protection of the San Francisco Water Department.

Presumably, SFWD would assume a major role in developing the management guidelines and have a review function in the approval process of land use activities proposed in Policy 104.

Policies 144, 145 and 146 address quarry development in eastern Alameda County. ECAP allows quarrying within the Large Parcel Agriculture, Resource Management, Watershed Management, Urban Reserve and Quarries land use designations. ECAP states that the Apperson Ridge Quarry has been approved under previous regulations and is expected to be developed. The primary impact of the Apperson Ridge Quarry on the Alameda Watershed will be that quarry trucks will cross watershed lands. The watershed resource management regulations provided for in Policy 104 can help to mitigate this transportation impact.

Policy 150 deals with the Sunol Valley quarries. "The County shall participate with the San Francisco Water Department in its planning efforts for SFWD-owned watershed lands within the Sunol Valley to ensure that future quarry activity is compatible with Sunol community interests and water management objectives [emphasis in original]."

Program 25 states that "The County shall work with . . . the San Francisco Water Department to incorporate continuous open space areas outside the Urban Growth Boundary into the Bay Area Greenbelt system [emphasis in original]."

Policy 153 states that quarry "reclamation plans are designed to restore biological value to sites through appropriate revegetation, contouring of lakes to simulate natural bodies of water, and protection or in-kind replacement of significant trees [emphasis in original]."

Chapter 5.8 of the environmental document, Visual and Aesthetic Resources, discusses the Sunol Water Temple: "In Sunol, the view from the road of the Water Temple (part of the City of San Francisco's Hetch Hetchy system) provides a unique visual landmark (6)." Chapter 5.8 also states that the Niles Canyon Road between Mission Boulevard and I-680 is expected to be designated a California State Scenic Highway.

Policies 114-116 relate to proposed grading requirements to be developed by Alameda County. These grading requirements may impact SFWD's activities at the Alameda Watershed. Policy 114 specifies that "The County shall require that where grading is necessary, the off-site visibility of cut and fill slopes and drainage improvements is minimized. Graded slopes shall be designed to simulate natural contours and support vegetation to blend with surrounding undisturbed slopes [emphasis in original]. Policy 115 specifies that "The County shall require that grading avoid areas containing large stands of mature, healthy vegetation, scenic natural formations, or natural watercourses [emphasis in original]."

Policy 116 specifies "The County shall require that access roads be sited and designed to minimize grading [emphasis in original]."

Policy 117 requires undergrounding of utility lines whenever feasible. When located aboveground, utility systems should be designed to have minimum visual impact.

Santa Clara County General Plan

The Santa Clara County General Plan was prepared by the City Planning Department's Advance Planning Office and was adopted in 1980. A draft updated version of the Santa Clara County General Plan is in press and is expected to be released in August; public comment meetings will be scheduled for the fall of 1994. No significant changes in the zoning classifications or regulations discussed in this report are in the new draft version according to officials at the Advance Planning Division of the Santa Clara County Planning Department.

The Santa Clara County General Plan Land Use Map classifies the SFWD watershed lands as Resource Conservation Area Other Public Open Lands. Lands within the watershed not owned by SFWD are classified as Resource Conservation Area Hillsides and Existing Regional Parks. Small enclaves of development within the watershed are zoned as Rural Residential Areas. These Rural Residential Areas are the result of a series of Site Specific Amendments passed since 1981. These Rural Residential Area sites are outside of the proposed urban service area and outside of any incorporated city. These sites contain a number of septic systems which could negatively impact the watershed.

Residential density in Rural Residential areas generally exceeds 5 to 20 acres per dwelling. This designation "is applied to areas which have an established pattern of small, primarily developed parcels assembled in aggregations large enough to be considered more than simple clusters of rural development (C-10)."

Policy CE 2 states that "Urban development should occur only within urban service areas and under city jurisdiction (E-6)." Urban Service Areas are proposed to be areas "without cumulative adverse impacts on the county's watersheds and other resources (E-6)." Policy CE 4 states that watershed lands, generally above 15 percent slope, are considered unsuitable for urban development.

The Resource Conservation Area land use category of Ranchlands is the second major land use category for privately owned land in the Santa Clara County portion of the Alameda Watershed. Land Use designation 28 describes Ranchlands as:

> Lands which are predominately used as ranches which are far away from the urban portions of the county. These lands are watersheds and provide such important resources as grazing lands, minerals, forests, animal habitat, rare or locally unique plant and animal communities, historic and archaeological sites, areas of scenic beauty, and recreational areas (C-7).

The Ranchlands discussion also states that Ranchland policies will be reviewed in one year: "Monthly subdivision and certificate of compliance data will be collected. If at the end of one year

activity in the Ranchlands approaches the limits for subdivisions, it will be necessary to revise the Ranchlands policies (C-7)." These policies have not been revised since the General Plan was adopted.

Ranchlands and Hillside Areas land use categories have minimum lot sizes that "shall be either those of the 20 to 160 acre slope density formula or 160 acres (C-8)."

Santa Clara County General Plan Policy NE 19 specifies the protection of water resources by:

a. Preserving open land in both agricultural and hillside watershed areas.

b. Preserving areas with prime percolation capabilities and avoiding placement of all potential sources of pollution in such areas.

c. Minimizing sedimentation and erosion through control of grading, quarrying, cutting of trees, removal of vegetation, placement of roads and bridges, use of offroad vehicles, and animal related disturbance of the soil.

d. Avoiding pollution by not allowing the location of septic systems, automobile dismantlers, waste disposal facilities, industries utilizing toxic chemicals, and other potentially polluting substances to be in creekside or residential areas when polluting substances could come in contact with floodwaters . . . or reservoir waters.

e. Avoiding establishment of excessive concentrations of septic systems over large land areas, and mitigating water quality impacts from existing concentrations (D-13).

The Santa Clara County Health Department is responsible for septic system regulation enforcement.

Policies relating to the natural environment specify controlling the use and disposal of pesticides, herbicides, toxic chemicals and agricultural chemicals in Santa Clara County. Reducing or eliminating the use of broadcast herbicide by public agencies is a county policy. Control of surface runoff by implementing the recommendations of the Regional Environmental Management Plan is Santa Clara County policy.

The Recreation and Culture chapter of the Santa Clara County General Plan lists the development of a Calaveras Reservoir Park and Ecological Reserve (H-15).

Santa Clara County's Office of Emergency Services has prepared and is responsible for implementing the county's Operational Area Emergency Plan. This Plan details the responsibilities of both public and private agencies in responding to major disasters (J-13).

San Mateo County General Plan

The San Mateo County General Plan was prepared by the San Mateo County Department of Environmental Management and Adopted in November 1986. Sections of the General Plan have been updated since 1986.

All Peninsula watershed lands are owned by the SFWD except for 355 acres along the western watershed boundary from Highway 92 to San Bruno. Most of this land is undeveloped open space consisting of seven slivers of land along the border of the Peninsula Watershed. About 10 percent of this land has been used for residential development at the northern tip of the watershed within the City of San Bruno (Montgomery Watson Technical Memorandum No 4). It is assumed that all buildings within this small residential enclave are connected to municipal sewerage systems.

The Peninsula Watershed of the SFWD is classified as General Open Space. General Open Space is defined as land:

(1) Where natural resources are in need of protection;
(2) Where there is managed production of resources;
(3) Where it is necessary to protect public health and safety; and
(4) Where outdoor recreation is or could be suitably provided (8.9P).

The following policies apply to the Peninsula Watershed:

Policy 1.32 specifies preparation of performance criteria and development standards for sensitive habitat and buffer zone areas.

Policy 1.36 requires the protection of water resource lands productive uses.

Policy 1.47 requires development of guidelines for vegetation and debris control in riparian corridors.

Policy 4.22 specifies the protection of the basic scenic character of forest lands by promoting the regulation of thinning and commercial harvesting.

Policy 4.44 specifies the designation of scenic roads and corridors and the regulation of development site and structure design controls. The SFWD Watershed is within the Junipero Serra Scenic Corridor.

Policy 6.1 specifies the provision for a balanced and equitable system of park and recreation facilities that meet identified needs of San Mateo County residents. The plan includes the SFWD Watershed in a recreation easement.

Policy 7.22 states that watershed lands are unsuitable for inclusion within city spheres of influence.

San Francisco Watershed lands are specifically discussed under Policy 9.43: "Recognize the San Francisco watershed lands as unique areas of special open space significance that should be protected from conflicting land uses in order to retain their value as open space, wildlife, water supply, and recreation resources." Policy 9.50 specifies continuance of the cooperative management of the

SFWD Watershed lands by the County, the City and County of San Francisco, the State of California, and the Golden Gate National Recreation Area.

Policy 10.2 calls for safeguarding the productive capacity of groundwater aquifers and storage reservoirs.

SUMMARY

Each county master plan reviewed proposes enhancement of SFWD watershed-based recreation opportunities. The single mention of SFWD watershed lands in the San Francisco Master Plan states that public access should be provided to portions of watershed lands that have "high recreational value." The Alameda County ECAP calls for enhancement of recreational uses at the Sunol Valley quarries and around the San Antonio and Calaveras Reservoirs. The Santa Clara County General Plan specifies the development of a Calaveras Reservoir Park and Ecological Reserve. The San Mateo County General Plan includes the Peninsula Watershed within a recreational easement area.

The Rural Residential land use category in the Santa Clara County General Plan has resulted in the building of dwelling units within the SFWD watershed and outside of the Santa Clara County Urban Service Area. Construction of septic sewerage systems at these dwellings and surface water runoff into the watershed pose contamination potentials that are the responsibility of the Santa Clara County Health Department; these issues are not addressed in the Santa Clara County General Plan.

In Santa Clara County, Rural Residential, Ranchland, and Hillside zoning classifications are the watershed conservation zones for watershed lands not owned by SFWD. Rural Residential zoning allows 5 to 20 acres per dwelling. Ranchland and Hillside zoning allows 20 to 160 acres per dwelling depending on the slope. Alameda County, in contrast, allows 360 acres per dwelling in large parcel agricultural areas including lands east of the San Antonio Reservoir, and 100 acres per dwelling in the small parcel agricultural areas including the Sunol Valley and areas along the major roads of the Alameda Watershed.

Alameda County's ECAP also provides for the development of Resource Management guidelines to protect the watershed. Neither San Mateo County nor Santa Clara County has this option. Santa Clara County's General Plan is being revised this year.

Appendix C-10

Technical Memorandum #9
Utilities and Infrastructure Review

June 1994

TECHNICAL MEMORANDUM NO. 9

UTILITIES AND INFRASTRUCTURE REVIEW

DATE: June 20 1994

TO: EDAW, Inc.

FROM: E. M. Rose and Associates

SUBJECT: Review of Infrastructure and Utilities at the San Francisco Water Department Peninsula and Alameda Watersheds

Note: This technical memorandum was prepared during the course of the watershed management planning process. The information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some specific issues noted in this memorandum may have been further refined through the planning process. These refinements are reflected in the Watershed Management Plans.

INTRODUCTION

The purpose of this technical memorandum is to provide a general description of the infrastructure and utility systems on the San Francisco Water Department (SFWD) Peninsula and Alameda watersheds.

San Mateo County Peninsula Watershed

Utility Systems

The regional Pacific Gas and Electric (PG&E) natural gas and electrical transmission lines for the San Francisco peninsula are located on the SFWD Peninsula Watershed along the I-280 corridor. Two 60Kv overhead electrical transmission lines together with a series of transformers run through the watershed west of I-280; they provide electrical service to the urbanized areas east of I-280 and to SFWD facilities on the watershed. One 60Kv overhead

electrical transmission line runs through the watershed along Highway 92 to Half Moon Bay. A 60Kv electrical transmission line that runs from Pacifica to Half Moon Bay intermittently crosses the Peninsula Watershed property.

At Hillcrest Street, Trousdale Boulevard and San Bruno Avenue, SFWD electrical service lines originate from PG&E transformers. These lines provide electrical services to the watershed keeper cottages, and the Pilarcitos Dam. Telephone service lines now are located underground; they cross the San Andreas Dam and then join the overhead electrical lines west of the San Andreas Dam. This system is basically a residential service system maintained by the SFWD. The Pilarcitos Dam electrical service is under a 3-phase service, according to SFWD electricians.

Watershed keeper cottages have propane tanks for cooking and heating. Two 30-inch PG&E natural gas transmission lines run along the I-280 corridor and end in San Francisco. These natural gas transmission lines service the entire peninsula and San Francisco; they operate at 335 lbs. pressure. Because this line is over 60 lbs. pressure, it is classified as a transmission line according to PG&E.

Water Supply and Sewerage

Recently the two cottages closest to Hillsborough and Burlingame were connected to their respective municipal water systems because the SFWD watershed water pipes were an unreliable source of supply because they did not always have an adequate capacity. All other watershed keeper cottages and SFWD facilities are supplied by either spring water lines or filtration plant water piped to individual cottages or other SFWD watershed facilities as required.

Emergency fire water facilities on the watershed consist of water hydrants at the cottages connected to a 2-inch supply pipe, and some water hydrants along the Sawyer Camp Trail that are also connected to a 2-inch supply pipe. The reservoir-lakes are the major source of fire fighting water supplies at the watershed.

No sewer lines are located on the Peninsula Watershed lands owned by SFWD. The Filoli complex has a septic system and leach field. The eight chemical and/or vault flush toilets at the Sawyer Camp Trail are currently serviced by SFWD staff. This year, the San Mateo County Parks Department will assume that task. In conjunction with a proposed expansion of Sawyer Camp Trail, the portable toilets will be replaced with permanent vault toilets according to the proposal prepared by San Mateo County. Two chemical toilets located at the Pulgas Water Temple and vault toilets located at the Pilarcitos Picnic area are regularly serviced by SFWD crews. All 10 cottages and other SFWD plumbing facilities on the watershed collect sewerage in holding tanks that are regularly serviced by SFWD staff.

Watershed Roads

The SFWD geographic information system developed by EDAW as a part of this planning activity has mapped all roads on the Peninsula Watershed. A total of 100 miles (371 acres) of paved roads and 39 miles (54 acres) of unpaved roads and trails have been identified on the Peninsula Watershed. The road system consists of:

Primary highway	25.6 miles
Freeway ramps	10.7 miles
Secondary highway	15.8 miles
Paved roads/streets	47.6 miles
Unpaved roads	34.6 miles
Trails	4.0 miles

The major transportation corridor through the Peninsula Watershed is I-280 or the Junipero Serra Freeway. About 14 miles of I-280 traverse the Peninsula watershed. Six interchanges provide local access to watershed areas. These interchanges are: the Larkspur-Hillcrest interchange, Black Mountain interchange, Bunker Hill interchange, the Route 92 interchange, Edgewood Road interchange, and the South Canada Road interchange. Most recent average daily traffic volumes for watershed area streets and highways are presented in Table 1.

Alameda Watershed

Utility Systems

Pacific Gas and Electric (PG&E) natural gas and/or electrical transmission lines are located in two corridors of the SFWD Alameda Watershed. A 230,000 volt electrical transmission line runs west of the Calaveras Reservoir from the PG&E Newark substation to the Metcalf substation south of San Jose. One 60Kv overhead electrical transmission line runs along Vallecitos Road; 60Kv and 115Kv overhead electrical transmission lines run along I-680 to the Newark substation. These 60Kv lines provide electrical services to watershed facilities. According to *San Francisco Water and Power*, a publication of the San Francisco Public Utilities Commission, the Hetch Hetchy "Moccasin-Newark line operates at 115Kv for its 98.5 mile length. . . . Following the [Hetch Hetchy] Aqueduct right-of-way as far as the Tesla Portal, the line was built during 1923 and 1924, terminating at the PG&E Newark Substation (page 43)."

[In *San Francisco Water and Power*, it states that "Hetch Hetchy's three power plants generate over two billion Kwh of electricity a year. A quarter of that goes to satisfy San Francisco's municipal needs, including the Municipal Railway, (other city facilities), and street lighting. The balance is sold to central California irrigation districts and industrial customers (43)."]

TABLE 1
AVERAGE DAILY TRAFFIC VOLUMES
SAN FRANCISCO PENINSULA WATERSHED

SAN MATEO COUNTY DEPARTMENT OF PUBLIC WORKS DATA

Edgewood Road (E of Canada)	1992-3 av.	3,172
Canada Road (S of Highway 92)	1990-3 av.	1,937
	4-5-92 (bicycles)	1,525
Canada Road (S of Edgewood)	1992-3 av.	3,208
Skyline Blvd. (betw. Bunker Hill & Crystal Springs)	1990-3 av.	1,830
Skyline Blvd. (betw. Crystal Springs & Golf Course)	1990-3 av.	2,705
Skyline Blvd. (N of Summit)	1990-3 av.	4,673

CALTRANS DATA

Route 35		
at Kings' Mountain	1992 av.	2,175
N Jct. Rte 92	1992 av.	2,500
at Crystal Springs	1992 av.	13,000
at San Bruno	1992 av.	17,500
Sneath	1992 av.	21,500
Route 92		
Ralston-Polhemus Int.	1992 av.	65,000
Alameda de Las Pulgas Int.	1992 av.	69,000
Jct. Rte. 82	1992 av.	72,000
Route 280		
Canada Road Int.	1992 av.	90,000
Edgewood Road Int.	1992 av.	90,000
Jct. Rte 35 N	1992 av.	93,000
Jct. Rte 380 E	1992 av.	85,000

According to PG&E, three high pressure natural gas transmission lines run through the watershed in the San Antonio Valley east of Vallecitos Road: one 24-inch diameter(500 lb.), one 22-inch diameter(500 lb.), and one 36-inch diameter(600-700 lb.). These gas transmission lines are subsurface through the watershed.

The Chevron Pipe Line Company operates a pipeline that transports refined petroleum products from the Bethany Pump Station near Tracy to a terminal in San Jose. This pipeline runs through the San Antonio Reservoir watershed, runs south parallel to and then crosses Calaveras Road and Alameda Creek in the Sunol Valley. About 3.3 miles of this pipeline are within the SFWD watershed property. According to the Watershed Sanitary Survey prepared as a part of this planning effort, Chevron plans to reroute the pipeline segment that runs east of the Alameda Creek crossing.

Local utilities at the Alameda Watershed are a mix of utility-owned and SFWD-owned electrical and telephone lines. The more remote the cottage or other facility, the more likely that the utility lines servicing the facility will be owned and maintained by SFWD. Water supplies at the watershed cottages are provided by a combination of spring water lines, municipal water service from local water retailers, and SFWD filter plant water.

Sanitation facilities at SFWD facilities at the Alameda watershed are chemical toilets. The Sunol Valley Golf Course operates a small waste water treatment plant that has a capacity of about 12,000 gallons per day. The quarry operations and nurseries in Sunol Valley have either chemical or vault toilets. The Sunol Regional Wilderness Area maintains 25 chemical toilets and 5 vault toilets. (See the discussion in the Watershed Sanitary Survey on the East Bay Regional Parks District watershed sanitary facilities.)

According to the Alameda Watershed Sanitary Survey, no septic systems have been identified on SFWD-owned lands at the Alameda watershed. Septic systems for residential uses do occur on a number of privately and institutionally owned parcels on the watershed. Septic systems have been identified in the following areas:

> Happy Valley area along Arroyo de la Laguna in Alameda County, unknown number
>
> Sunol-Kilkare area along Sinbad Creek in Alameda County, unknown number
>
> Welch Creek Road near the Sunol water treatment plant in Alameda County, unknown number
>
> South of the Calaveras Reservoir near Felter Road in Santa Clara County, 65 systems since 1955, unknown number in Calaveras watershed
>
> Mt. Hamilton/San Antonio Road/Grant Park areas of Santa Clara County, 29 systems registered since 1955
>
> Mt. Hamilton Observatory in Santa Clara County, 29 systems registered

Emergency fire water facilities on the watershed consist of water hydrants at the cottages connected to 2-inch supply pipe and 3 water hydrants along the Calaveras pipeline. Water

supply systems are also located at the leasehold nursery operations at the Alameda Watershed. Intermittent water availability in the Calaveras pipeline may be a problem if this water supply is required for fire fighting. The reservoir-lakes are the major source of fire fighting water supplies at the watershed.

Watershed Roads

The SFWD geographic information system developed by EDAW as a part of this planning activity has mapped all roads on the Alameda Watershed. A total of 51 miles (163 acres) of paved roads and 106 miles (143 acres) of unpaved roads and trails have been identified on the Alameda watershed. The road system consists of:

Primary highway	3.3 miles
Freeway ramps	2.7 miles
Secondary highway	11.0 miles
Paved roads/streets	34.3 miles
Unpaved roads	82.0 miles
Trails	24.0 miles

The major transportation corridor near the Alameda Watershed is I-680. About 2 miles of I-680 traverse the Alameda watershed. The Pleasanton-Sunol and Highway 84-Calaveras Road interchanges provide local access to watershed areas. Most recent available average daily traffic volumes for watershed area streets and highways are presented in Table 2.

TABLE 2

AVERAGE DAILY TRAFFIC VOLUMES

ALAMEDA WATERSHED

SANTA CLARA COUNTY DEPARTMENT OF TRANSPORTATION DATA		
Calaveras Blvd. beyond Felter	1984 av.	140
Felter Road nr. Calaveras	1984 av.	970
Marsh Road nr. Felter	1984 av.	150
TRI-VALLEY TRANSPORTATION AUTHORITY DATA		
I-680		
N of Highway 84	1990 av.	88,400
N of I-580	1990 av.	107,600
Highway 84 at Vallecitos Road	1990 av.	11,000

Appendix C-11

Technical Memorandum #10
Regional Recreational Facility Inventory
June 1994

TECHNICAL MEMORANDUM NO. 10

REGIONAL RECREATIONAL FACILITY INVENTORY

DATE: June 20 1994

TO: EDAW, Inc.

FROM: E. M. Rose and Associates

SUBJECT: Review of Regional Recreational Facilities adjacent to the San Francisco Water Department Peninsula and Alameda Watersheds

Note: This technical memorandum was prepared during the course of the watershed management planning process. The information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some specific issues noted in this memorandum may have been further refined through the planning process. These refinements are reflected in the Watershed Management Plans.

INTRODUCTION

The purpose of this regional recreational facility inventory is to document the recreational facilities around the Alameda and Peninsula watershed lands. The inventory also includes all golf courses, public and private, identified in the survey area for each watershed.

Generally, parks and recreation areas are defined as regional if they include more than 100 acres. An exception to this size limit is made for the Fitzgerald Marine Reserve on the San Mateo coast, because it is a unique recreational resource in the project area. Parks and recreation areas are excluded if they are not accessible to the general public. Golf courses, however, are listed even if they are not accessible to the general public.

For the Alameda Watershed, the East Alameda County Area generally south of the I-580/I-238 line is included in the inventory. This area includes the cities of Livermore, Pleasanton, Dublin, Fremont, Newark, Union City, Hayward and the town of Sunol. In Santa Clara county, the area covered by the inventory is generally east of the Lawrence Expressway and

North of I-280. This area includes parts of the cities of Milpitas, San Jose, Santa Clara, and Sunnyvale.

For the Peninsula Watershed, Santa Clara County areas west of the Lawrence Expressway to the Santa Clara-Santa Cruz County boundary along Skyline, and north of the southern limit of I-280 are included in the inventory. Peninsula Watershed/San Mateo County areas covered by the inventory are north of Highway 84 to the San Francisco City and County boundary. Peninsula Watershed/San Francisco City and County areas include all regional parks and recreational lands.

The Alameda and Peninsula Watershed vicinity maps which follow the inventory indicate the park and recreation facilities by number.

Facility reference numbers aremapped on the attached Alameda and Peninsula Watershed figures unless noted by an asterisk (*).

SAN FRANCISCO WATERSHED MASTER PLAN
REGIONAL RECREATIONALFACILITY INVENTORY

Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
	ALAMEDA WATERSHED - ALAMEDA COUNTY				
1	Tassajara Creek Regional Park	451 acres	Kite flying, picnic areas	Tassajara Rd., Pleasanton	East Bay Regional Parks District (EBRPD)
2	Shadow Cliffs Regional Rec. Area	249 acres	Boating, fishing, swimming	Stanley Blvd., east of Valley Ave., Pleasanton	EBRPD
3	Pleasanton Ridge Regional Park	1700 acres	10 m. hiking, equestrian, and mountain biking, trials	Foothill Blvd., 2 m. S. of Castlewood	EBRPD
4	Sycamore Grove Regional Park	510 acres	Paved bike pat, skating; hiking, equestrian and mountain bike trails	Holmes & Wetmore Rds., Livermore	Livermore Area Recreation and Park District
5	Carnegie State Vehicular Recreation Area	1500 acres	Motorcycle riding, camping, day-use picnic areas	Coral Hollow Rd., 6 m. W of I-580, Livermore	Cal. Parks & Rec.
6	Del Valle Regional Park	4500 acres	Camping, swimming, boating, hiking, biking	Del Valle Blvd., S. of Mines Rd.	EBRPD
7	Sunol-Ohlone Regional Wilderness Area	5924 acres	35 m. hiking, equestrian trials, camping	Geary Rd. off Calaveras Rd., Sunol	EBRPD
8	Mission Peak Regional Preserve	3000 acres	Hiking, equestrian and biking trails	Mill Creek Rd., off Mission Blvd., Fremont	EBRPD
9	Alameda Creek Quarries Regional Rec. Area /Regional Trail	485 acres	None - undeveloped	Alvarado-Niles Rd., Union City	EBRPD
10	Ardenwood Regional Preserve	205 acres	Historic farm, Ohlone village and burial site, picnic area	Decoto Rd. and Ardenwood Blvd., Union City	EBRPD
11	Coyote Hills Regional Park	1064 acres	40 m. trials, picnic areas, wildlife sancturary	8000 Patterson Ranch Rd., Newark	EBRPD
12	San Francisco Bay National Wildlife Refuge	20000 acres	Birding, fishing, nature trails	Marsh Land Rd., Newark	U.S. Dept. of Interior
13	Garin Regional Park/Dry Creek Pioneer Regional Park - Hayward	3000 acres	20 m. hiking trails, fishing, picnic area	Garin Ave., off Mission Blvd.	EBRPD
14	Hayward Regional Shoreline	2000 acres	7 m. hiking and biking trails, ecological exhibits	West Winton Ave., west of Clawiter Rd., Hayward	EBRPD
15	Los Positas Golf Club			917 Clubhouse Dr., Livermore	

SAN FRANCISCO WATERSHED MASTER PLAN
REGIONAL RECREATIONALFACILITY INVENTORY

Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
16	Springtown Golf Club			939 Larkspur Dr., Livermore	
17	Castlewood Golf Club - Pleasanton			707 Country Club Circle, Pleasanton	
18	Pleasanton Fairways Golf Course			Alameda County Fairgrounds, Pleasanton	
19	Sunol Valley Golf Club			6900 Mission Rd., Sunol	
20	Parkway Golf Club, Fremont			3400 Stevenson Blvd., Fremont	
21	Skywest Golf Course			Golf Course Service Road, Hayward	
22	Hayward Golf Course			Industrial Parkway west of Mission Blvd., Hayward	
23	Sunnyhills Golf Club			Warm Springs Blvd. and Scott Creek Rd.	
	ALAMEDA WATERSHED - SANTA CLARA COUNTY				
24	Ed R. Levin County Park	1544 acres	16 m. hiking and equestrian trials, boating, fishing, volleyball	3100 Calaveras Rd., Milpitas	Santa Clara County Parks
25	Sunnyvale Baylands County Park	177 acres	Jogging trails, playground, nature trails	Caribbean Dr., off Lawrence Expressway	Santa Clara County Parks
26	Alum Rock Park	700 acres	20 m. hiking and equestrian trails	Alum Rock Ave., at Crothers Road, San Jose	Santa Clara County Parks
27	Joseph D. Grant County Park	9522 acres	50 m. trails, camping, fishng, picnic areas	Mt. Hamilton rd., at Quarry Rd., San Jose	Santa Clara County Parks
28	Coyote Valley-Hellyer County Park	223 acres	6 m. hiking and bike trials, Olympic velodrome, fishing	985 Hellyer Ave., San Jose	Santa Clara County Parks
29	Spring Valley Golf Course			Levin County Park	
30	Summit Pointe Golf Club			1500 Country Club Drive, Milpitas	
31	Tularcitos Golf & Country Club			E. Calaveras Blvd., Milpitas	

SAN FRANCISCO WATERSHED MASTER PLAN
REGIONAL RECREATIONALFACILITY INVENTORY

Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
32	Pruneridge Golf Course			Saratoga Ave., east of San Tomas Expr., Santa Clara	
* 33	Santa Clara Golf and Tennis Club			Lafayette betw. Hwy 237 and Tasman Ave.	
* 34	San Jose Municipal Golf Course			1560 Oakland Road, San Jose	
35	San Jose Country Club			15571 Alum Rock Ave., San Jose	
36	Thunderbird Golf & Country Club			221 South King Road, San Jose	
37	Pleasant Hills Golf & Country Club			2050 South White Road, San Jose	
38	Alma Golf Club			6663 Hampton Dr., San Jose	
	PENINSULA WATERSHED - SANTA CLARA COUNTY				
1	Los Trancos Open Space Preserve	270 acres	5 m. hiking and equestrian trails	Page Mill Rd., off Hwy. 35	Mid-Penninsula Open Space District (MPOSD)
2	Rancho San Antonio Open Space Preserve	1250 acres	Hiking and equestrian trials, picnic areas	Moody Rd., off I-280	MPOSD
3	Monte Bello Open Space Preserve	2970 acres	13 m. trails, backpack camping, wine tasting at Picchetti Ranch	Page Mill Rd., at Hwy 35	MPOSD
4	Blackberry Farm Golf Course			22100 Stevens Creek Blvd., Cupertino	
5	Los Altos Golf and Country Club			1560 Country Club Drive., Los Altos	
6	Moffett Field Golf Club			Moffett Field Naval Air Station, Sunnyvale	
7	Palo Alto Hills Golf and Country Club			3000 Alexis Drive, Palo Alto	
8	Palo Alto Municipal Golf Course			1875 Embarcadero Road, Palo Alto	

Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
9	Shoreline Golf Course			2600 N. Shoreline Blvd., Palo Alto	
10	Stanford Golf Course			Stanford University Campus, Stanford	
* 11	Sunken Gardens Municipal Golf Course			1010 S. Wolfe Rd., Sunnyvale	
12	Sunnyvale Municipal Golf Course			605 Macara Avenue, Sunnyvale	
	PENINSULA WATERSHED - SAN MATEO COUNTY				
13	Palo Alto Bay Lands Nature Preserve	575 acres	Nature trails	Embarcadero Rd., Palo Alto	City of Palo Alto Parks
14	Russian Ridge Open Space Preserve	1500 acres	6 m. hiking and equestrian trails	Rte. 35 at Alpine Road	MPOSD
15	Skyline Ridge Open Space Preserve	1250 acres	8 m. hiking and equestrian trails	Hwy 35	MPOSD
16	Windy Hill Open Space Preserve	1130 acres	10 m. hiking and equestrian trails	Rte. 35, 2 mi. S. of Hwy 84	MPOSD
17	La Honda Creek Open Space Preserve	840 acres	Hiking and equestrian trails	LaHonda Road	MPOSD
18	El Corte De Madera Open Space Preserve	2800 acres	13 m. hiking and equestrian trails	Rte. 35, 4 m. N. of Hwy 84	MPOSD
19	Coal Creek Open Space Preserve	490 acres	4 m. hiking and equestrian trails	Rte. 35, 1 m. N. of Page Mill/ Alpine intersection	MPOSD
20	Wunderlich County Park	942 acres	20 m. hiking and equestrian trails	4040 Woodside Rd., W. of Woodside	San Mateo County Parks
21	Pleger Estate - Golden Gate National Recreation Area (GGNRA)	600 acres	new purchase, undeveloped	Woodside Road	National Park Service
22	Huddart County Park	974 acres	15 m. hiking and equestrian trails, playground, archery range	Kings Mountain Rd., 2 m. W of Hwy. 84	San Mateo County Parks
23	Edgewood County Park	290 acres	Hiking and equestrian trails	Edmonds Rd., nr. Crestview Drive	San Mateo County Parks
24	Pulgas Ridge Open Space Preserve	293 acres	Hiking and equestrian trails	I-280 at Edgewood Rd., San Carlos	MPOSD

SAN FRANCISCO WATERSHED MASTER PLAN
REGIONAL RECREATIONALFACILITY INVENTORY

Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
25	Filoli Center	654 acres	Nature trails, historic house and gardens	Canada Road, Peninsula Watershed	Private non-profit foundation
26	Purisima Creek Redwoods Open Space Preserve	1121 acres	Hiking and equestrian trails, picnic areas	Higgins-Purisima Rd., 1 m. east	M P O S D
27	Burleigh H. Murray Ranch State Park	1128 acres	Some hiking trails, undeveloped	1 5 m. E. of Hwy. 1 at Purisima Creek Rd.	Cal. State Parks
28	Half Moon Bay State Beach	170 acres	Equestrian trail, beach	Highway 1, Half Moon Bay	Cal. State Parks
29	James V. Fitgerald Marine Res.	50 acres	Fishing, nature programs	Off Calif. Ave at N. Lake & Nevada Ave, Moss Beach	San Mateo County Parks
30	Montara State Beach & Gray Whale Cove State Beach	681 acres	1/2 mi. beach, picnic, fishing	Highway 1 & 2nd St., Montara	Cal. State Parks
31	Sugarloaf Mountain Open Space	224 acres	hiking, picnic area	DeAnza Blvd., west of Hwy 92	City of San Mateo Parks
32	Coyote Point County Recreation Area	727 acres (180 land acres)	Swimming beach, nature trails, museum, shooting range	End of Coyote Point Drive, San Mateo	San Mateo County Parks
33	San Pedro Valley County Park	1150 acres	6 m. hiking trails, picnic areas, nature trails	600 Oddstad Rd., at Linda Mar Blvd., Pacifica	San Mateo County Parks
34	Junipero Serra County Park	108 acres	Picnic areas, hiking trails	1801 Crystal Springs Rd., San Bruno	San Mateo County Parks
35	Sweeney Ridge - GGNRA	1000 acres	Some hiking trails, mostly undeveloped	Mori's Point Rd., east of Highway 1, Pacifica	National Park Service
36	Milagra Ridge - GGNRA	232 acres	Some hiking trails, mostly undeveloped	Sharp Park Road west of Skyline Blvd., Pacifica	National Park Service
37	Mill Canyon Park and Open Space Area	35 acres	Walking trail, mostly undeveloped	Arguello Drive, Burlingame	City of Burlingame, Parks Dept.
38	San Bruno Mountain County & State Parks	2267 acres	12 m. hiking, biking and equestrian trails, picnic areas	Guadalupe Canyon Parkway nr. Summit Rd., between Brisbane and Daly City	San Mateo County Parks and Cal. State Parks
39	Emerald Hills Country Club			1059 Wilmington Way, Redwood City	
40	Menlo Country Club			Woodside Road, Woodside	

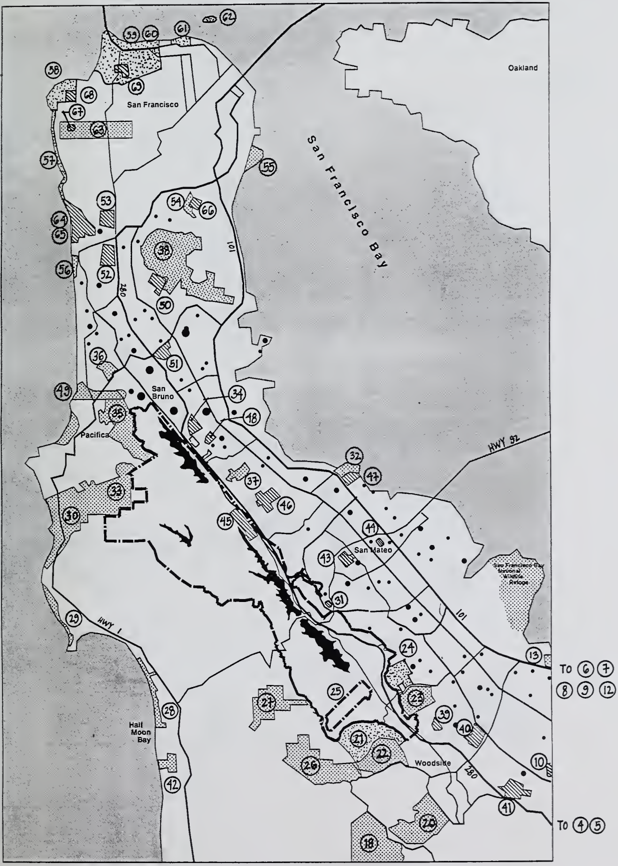
Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
41	Sharon Heights Golf & Country Club			2900 Sand Hill Road, Menlo Park	
42	Half Moon Bay Golf Links			2000 Fairview Dr., at Highway 1, Half Moon Bay	
43	Peninsula Golf & Country Club			701 Madera Drive, San Mateo	
44	Bay Meadows Golf Club			Bay Meadows Race Course, San Mateo	
45	Crystal Springs Golf Club			6650 Golf Club Dr., Burlinghame	
46	Burlingame Country Club			80 New Place Road, Hillsborough	
47	City of San Mateo Tom Fry Golf Course			Coyotoe Point Road, San Mateo	
48	Green Hills Country Club			Ludeman Lane, Millbrae	
49	Sharp Park Golf Course			Sharp Park Road, Pacifica	
50	Cypress Hills Golf Club			1777 Hillside Blvd., Colma	
51	California Golf Club of San Francisco			844 West Orange Avenue, South San Francisco	
52	Lake Merced Golf & Country Club			2300 Junipero Serra Blvd., Daly City	
53	San Francisco Golf Club			Junipero Serra Blvd., Daly City	
	PENINSULA WATERSHED - SAN FRANCISCO CITY AND COUNTY				
54	McLaren Park	318 acres	Basketball, multi-use field, picnic area, playground, tennis, lake	Sunnydale Avenue west of Bayshore Blvd., San Francisco	San Francisco Recreation and Parks
55	Candlestick Pt. State Rec. Area	252 acres	Paved bike trails, fishing piers, picnic areas, windsurfing	Hunters Point Expressway east of Candlestick Park, San Francisco	557-4069 rec. mess.; 557-2593

SAN FRANCISCO WATERSHED MASTER PLAN
REGIONAL RECREATIONALFACILITY INVENTORY

Ref. #	Name of Facility	Size	Facilities/Activities permitted	Location	Agency
56	Ft. Funston - GGNRA	5000 acres- San Francisco total	Hiking trails, beaches, historic sites	Skyline Boulevard, San Francisco	National Park Service
57	Ocean Beach -GGNRA		Beach, multi-use trail	West of The Great Highway, San Francisco	National Park Service
58	Lands End		Hiking trails, view points,historic sites	Point Lobos Avenue, San Francisco	National Park Service
59	The Presidio & Fort Point - GGNRA	1481 acres	Historic fort, hiking and biking trails; under development	Bordered by Lyon Street, West Pacific Avenue, Lincoln Blvd., San Francisco	National Park Service
60	Crissy Field, Marina Green, Golden Gate Promenade - GGNRA		Beach, hiking and running trails	Marina Blvd., San Francisco	National Park Service
61	Fort Mason - GGNRA		Fishing piers, museums, theaters	Bordered by Laguna Street, Bay Street, Van Ness Avenue	National Park Service
62	Alcatraz Island- GGNRA		Historic site, hiking trails	San Francisco Bay	National Park Service
63	Golden Gate Park	1017 acres	Gardens, museums, archery, football, basketball, baseball, softball, biking, skating, soccer, tennis, lawn bowling, petanque, play facilities,	Bordered by Stanyan Street, The Great Highway, Lincoln Way and Fulton Street, San Francisco	San Francisco Recreation and Parks
64	Olympic Country Club			22 Skyline Blvd., San Francisco	
65	Harding Park Municipal Golf Course			Harding & Skyline Blvds., San Francisco	
66	Gleneagles International Golf Course at McLaren Park			2100 Sunnydale Avenue, San Francisco	
67	Golden Gate Park Municipal Golf Course			Golden Gate Park, west end	
68	Lincoln Park Municipal Golf Course			Lincoln Park, San Francisco	
69	Presidio Golf Course			The Presido, San Francisco	

Peninsula Watershed

Surrounding Park and Regional Open Space Areas



▨ Regional Parks and Preserves

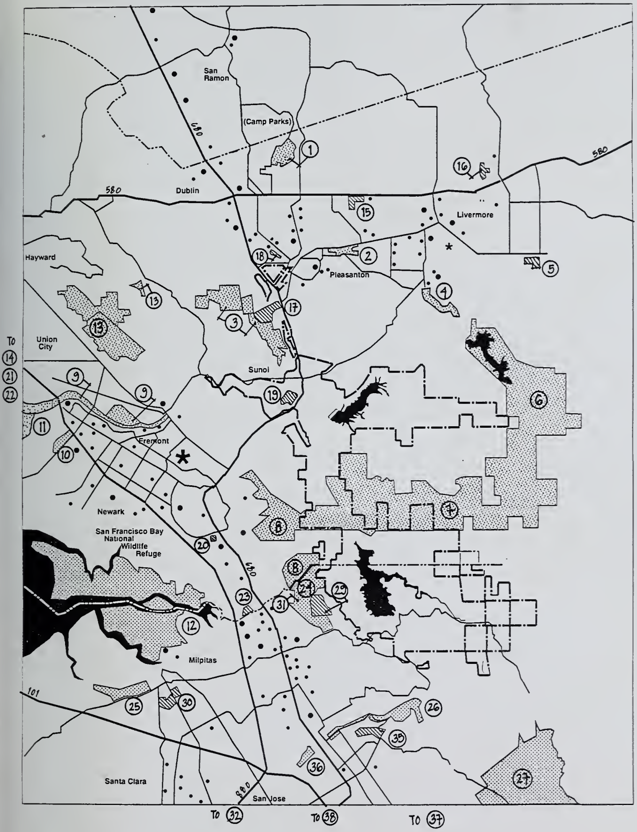
▧ Golf Course

* City Park

● Neighborhood Parks

Alameda Watershed

Surrounding Park and Regional Open Space Areas



▒ Regional Parks and Preserves

▨ Golf Course

★ City Park

● Neighborhood Parks

Appendix C-12

Technical Memorandum #11
SFPUC Policies
September 1993

TECHNICAL MEMORANDUM NO. 11
SFPUC POLICIES

DATE: September 30, 1993

PREPARED BY: EDAW, Inc.

SUBJECT: SFPUC Policies

Note: This technical memorandum was prepared during the course of the watershed management planning process. The information was gathered at specific points in time during the planning process and does not necessarily represent the information contained in the Watershed Management Plans. Some specific issues noted in this memorandum may have been further refined through the planning process. These refinements are reflected in the Watershed Management Plans.

Introduction

The purpose of this memorandum is to review resolutions and policies adopted by the San Francisco Public Utilities Commission (SFPUC) that apply to the management of the San Francisco Water Department's Peninsula and Alameda Watersheds. Thirty policies are listed by number and then further identified by subject and a brief description. Eighteen resolutions are listed by number and then briefly summarized. The Statement of Policy for each of the nineteen policies and the full eighteen resolutions are attached.

Policy No.

WD 3.2 **Land in Alameda and Santa Clara Counties**. The Commission approved interim concepts developed in 1968 by Wilsey and Hamm and Metcalf and Eddy entitled "Interim Preservation and Recreation Concepts San Francisco Water Department Lands." The Commission reaffirmed its policy of continued ownership of these lands for water supply purposes with allowance of other uses when consistent with water supply (Resolution 68-0138; Adopted February 13, 1968).

WD 3.3 **San Mateo County Land.** The Commission approved interim concepts developed in 1968 by Wilsey and Hamm and Metcalf and Eddy for lands lying west of the Junipero Serra freeway. The Commission reaffirmed its policy of continued ownership for water supply purposes and allowance of other uses when compatible with water supply (Resolution 68-0422 and 67-0747; Adopted May 21, 1968).

WD 3.4 **Grant of Scenic and Recreation Easement.** The Commission approved the granting of easements to the federal government over the Peninsula Watershed (Resolution 68-0972; Adopted December 20, 1968).

WD 3.5 **Long-term Lease of Land.** The Commission established a policy of making land available on a long-term lease basis as necessary for adequate financing and to allow sale of property only in exceptional circumstances (Resolutions 70-0592 and 68-0163; Adopted September 22, 1970).

WD 3.6 **Lease Procedures.** The Commission adopted procedures for use of a competitive bid process but allowing negotiation of leases where there is only one interested party or where special circumstances exist (as approved by the Commission) which require negotiation. Under this policy, you would apparently have to justify the proposed short-term lease extension to Crystal Springs golf course (Resolution 74-0391; Adopted October 22, 1974).

WD 3.7 **Quarterly Report on Delinquent Lease Payments.** The Commission approved the furnishing of quarterly reports listing all delinquent leases.(Resolution 74-0392; Adopted October 22, 1974).

WD 3.8 **Lease - Renewal.** The Commission approved that all leases about to expire be brought to the Commission's attention prior to the expiration date. (Adopted April 8, 1975).

WD 3.9 **Peninsula Watershed Lands Recreational Development.** The Commission approved the EDAW plan dated August, 1975, reaffirming its policy of continued use of watershed lands for water supply purposes and allowing other uses when compatible with the primary purpose of water supply (Resolution 76-0047; Adopted January 27, 1976).

WD 3.10 **Night Lighting on Watershed Land.** The Commission voted to discontinue the use of night lighting at Crystal Springs golf course (Resolution No. 77-0477; October 25, 1977).

WD 3.11 **Insurance Requirement for Land Use Permits and Leases.** The Commission voted to consider comprehensive liability insurance of less than $1,000,000. (Resolution No. 77-0544; December 27, 1977).

WD 3.12 **Bee Keeping on the Watershed - Revocable Permits.** The Commission authorized the issuance of revocable permits for bee keeping purposes (Resolutions Nos. 77-0494 and 78-0059; Adopted February 14, 1978).

WD 3.13 **Bee Keepers - Insurance Requirement.** The Commission rejects the Bee Keeper's request for a reduced insurance requirement. (Resolutions 79-0039; Adopted January 23, 1979).

WD 3.14 **Secondary Use of Water Department Lands.** The Commission established that the secondary use of Water Department lands for agricultural or other purposes shall at all times be subordinate to the needs and interests of the Department to protect its watershed lands, pipelines, and other facilities from any harm (Resolution 95-0010; Adopted January 24, 1995).

WD 3.15 **Leases and Permits for Secondary Use of Water Department Lands and Rights-of-Way**. The Commission affirms the policies on issuance of leases and permits for the secondary uses of Water Department lands and rights-of-way (Resolution 95-0015; Adopted February 14, 1995).

WD 3.16 **Day Use and Special Use Permits.** The Commission authorizes the issuance of day permits and special use permits (Resolution 95-0026; Adopted February 28, 1995).

WD 2.4 **Access to Watershed - Closing Sawyer Camp Road.** The Commission approved the San Mateo County policy of closing Sawyer Camp Road between 7:00 p.m. and 7:00 a.m. and reaffirmed its cooperation with San Mateo County to allow public travel on the road during daylight hours (Resolution 68-0552; Adopted July 2, 1968).

WD 2.5 **Control of Trespassers on Watershed.** The Commission approved agreements between the General Manager of the SFWD and various chiefs of police for local law enforcement on the watersheds (Resolution 71-0102; Adopted March 23, 1971).

WD 2.6 **Indemnifying Sheriffs of Watershed Counties.** The Commission agreed to idemnify various county sheriffs for legal judgements arising from actions as special deputy sheriffs while performing duties for San Francisco (Resolution 77-0325; Adopted July 26, 1977).

WD 2.7 **Water Conservation and Use of Potable Quality Water.** The Commission approves the policy to encourage continuing water conservation measures within the entire service area. (Resolution 77-0012; Adopted January 11, 1977).

WD 2.13 **Access to Watershed - Crystal Springs Vista Point.** The Commission requested the Board of Supervisors of San Mateo County to enact an ordinance prohibiting parking at the Crystal Springs vista point between 7:00 p.m. and 7:00 a.m. (Resolution 78-0375; Adopted September 12, 1978).

WD 2.14 **Disapproving Access Roadway on Watershed Land.** The Commission disapproved a request to construct an access roadway to connect freeway 280 and Crestview Drive in San Carlos (Resolution 79-0445; Adopted November 13, 1979).

WD 2.19 **Memorandum of Understanding (MOU) with the Central California Coast Biosphere Reserve (CCCBR).** The Commission approved execution of the MOU with the CCCBR by the Water Department General Manager (Resolution 92-0357; Adopted December 8, 1992).

WD 2.23 **Right-of-Way Protection Program.** The Commission supports the Water Department in the implementation of the Right-of-Way Protection Program (Resolution 95-0044; Adopted March 14, 1995).

GM 2.2 **Firearms Prohibition.** The Commission voted to prohibit the unauthorized possession of firearms on Utilities' property. (Adopted July 9, 1979).

Additional Policies Pre-dating and Including 1968

WD 5.1 **Junipero Serra Freeway.** The Commission opposed construction of the freeway along the proposed route B and urged a more easterly route to protect water quality. The policy also sought to obtain state financing for any filtration plants required as a result of freeway construction (Resolutions 17,355; 17,825; 65-0220; 66-0896; 67-0891; 68-0971; and 69-0174; Adopted June 18, 1957).

WD 5.2 **Preservation of Natural Environment.** The Commission urged the State Highway Department to retain all trees and other natural growth during construction of the Junipero Serra freeway (Resolution 24, 085; Adopted June 30, 1964).

WD 5.3 **Eradication of Predatory Animals on Watershed.** The Commission authorized the Manager of Public Utilities to enter into an agreement with the U.S. Bureau of Sports Fishery and Wildlife to eradicate predatory animals in the Crystal Springs watershed (Resolution 67-0066; Adopted January 24, 1967).

WD 5.5 **Highway Route 186 and Interchange at Route 35 on Watershed Land.** The Commission approved the location of Route 186 and the interchange of this route with Highway 35 (Half Moon Bay/Skyline Ridge Road) subject to measures to protect water quality and a protection of the watershed area as a natural preserve, protection of riding trails and a proposed equestrian area (Resolution 69-0318; Adopted May 20, 1968).

BA 1.2 **Delegation of Authority - Permits.** The Commission authorized six general classes of permits for use of Water Department lands, including gardening and landscaping permits; usage by public agencies for utilities, etc.; uses by non-profit organizations; crossing by private utility companies; commercial usage; and agricultural/grazing usage (Resolutions 74-0390; 67-0833; 67-1090; 78-0458; and 81-0341; Adopted October 22, 1974).

BA 5.15 **Moratorium on Grazing Leases.** This moratorium was probably lifted as it was limited to the duration of the 1976-77 drought (Resolution 77-0199; Adopted April 26, 1977).

Resolution No.

82-0366 Resolved, That the Public Utilities Commission expresses its support of State Proposition 13, the Water Resources Conservation and Efficiency Act, on November 2, 1982 ballot (Adopted August 24, 1982).

82-0405 Resolved, That the General Manager of Public Utilities is empowered to sign the [Mutual Assistance] Agreement with any changes therein which do not change the material substance thereof, and the Secretary of the Commission is authorized and directed to attest the same (Adopted September 28, 1982).

84-0539 Resolved, That this Commission hereby adopts a policy that it will not in the future approve any east side road connections through the watershed from local roads to Interstate Highway 280 across the Scenic and Recreation Easement (Adopted November 13, 1984).

84-0540 Resolved, That this Commission approves the proposed road connection subject to the conditions that the Commission's concerns regarding the maintenance of the security of its watershed lands and emergency vehicle passage underneath the roadway will be satisfactorily settled, and the appropriate contract will be returned to the Commission for final approval (Adopted November 13, 1984).

85-0333 Resolved, That this Commission concurs with and approves (subject to further approval by the Board of Supervisors and the Mayor) the settlement recommendation of the City Attorney that the aforesaid litigation be compromised settled by execution of an easement deed granting plaintiffs a right-of-way over a watershed property… (Adopted August 27, 1985).

86-0178 Resolved, That this Commission approves the amended road easement for the Apperson Ridge Quarry, the Memorandum of Understanding with the Alameda County Department of Public Works and the Memorandum of Agreement with the quarry operator…(Adopted May 13, 1986).

87-0029	Resolved, That this Commission hereby approves the terms and conditions and authorizes the execution of that certain 106± acre lease to Recreation Express... (Adopted January 27, 1987).
87-0172	Resolved, That this Commission authorizes the General Manager of the Water Department to enter into a memorandum-of-understanding...to allow San Francisco to reimburse the Association for appropriate expenses incurred in system-wide public information activities (Adopted May 12, 1987; also Resolution 88-0181 adopted May 24, 1988).
87-0361	Resolved, That this Commission authorizes the General Manager of the Public Utilties Commission to enter into an agreement with the United States Geological Survey to assess the supply potential of San Francisco's groundwater resources...(Adopted September 8, 1987).
89-0033	Resolved, That the General Manager of the Water Department is authorized to file with FERC an application for a Preliminary Permit to study power production at Calaveras...(Adopted January 24, 1989).
90-0167 MR	Authorizing the City Attorney to file suit under the California Environmental Quality Act against Modesto Irrigation District, the City of Modesto, and the Del Este Water Company (Adopted 1990).

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department

Policy Number: WD 3.2

Date Adopted: February 13, 1968

History:

Derivation:

Resolution: 68-0138

Minutes Page:

Subject: Alameda and Santa Clara Counties Land

Statement

The Public Utilities Commission approves in principle the interim concepts presented in the preliminary report entitled "Interim Preservation and Recreation Concepts San Francisco Water Department Lands, Alameda-Santa Clara Counties," dated 1968 of Wilsey and Ham and Metcalf and Eddy, Consultants, and reaffirms its policy of continued ownership of these lands for public water supply purposes primarily, and such incidental agricultural, recreational, and other appropriate uses, all of which are to be subordinate to the primary purpose of protecting water quality and water production on these lands, for which purposes these lands were originally acquired and are now held in trust.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.3
	Date Adopted: May 21, 1968
History:	**Derivation:**
	Resolution: 68-0422 67-0747
	Minutes Page:
Subject: San Mateo County Land	

Statement

The Public Utilities Commission approves the concepts prepared in the Joint Venture report of Wilsey & Ham and Metcalf & Eddy, Consultants for the lands lying west of the Junipero Serra Freeway, and reaffirms its policy of continued ownership of these lands for public water supply purposes primarily, along with open space, diversified recreation and other public uses, all of which must be compatible with the primary purposes of water production and water quality protection for which these lands were originally acquired and are now held in trust.

This Commission requests the General Manager of Public Utilities to make further studies of those several small pieces of land which will be severed from the watershed and that lie east of the Junipero Serra Freeway based on the ridge route location, with the objective of putting these lands to the highest possible use consistent with the purpose for which the lands were acquired.

The use and enjoyment of these lands under the aforesaid policy shall be available to the public insofar as it does not conflict with the primary purposes of water production and water quality protection.

The expression of policy contained in this resolution is to be transmitted to the Mayor and the Board of Supervisors with the recommendation that they approve the plan and policy herein expressed so as to make it clear that this is the official policy of the City and County of San Francisco with respect to lands owned in San Mateo County.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.4
	Date Adopted: December 20, 1968
History:	**Derivation:**
	Resolution: 68-0972
	Minutes Page:
Subject: Grant of Scenic and Recreation Easement	

Statement

The Public Utilities Commission, in consideration of the California Highway Commission adopting a ridge route alignment acceptable to and approved by this Commission and in further consideration of the additional cost to be incurred by the United States of America and the State of California in relocating the freeway along a ridge route alignment, does hereby approve all of the terms and conditions of (1) that certain form of grant of scenic and recreation easement to the United States of America as grantee covering approximately 4,000 acres of the Peninsula watershed lands east of the reservoirs and (2) that certain form of grant of scenic easement to the United States of America as grantee covering the remainder of the approximately 19,000 acres of Peninsula watershed lands.

A copy of this resolution is to be transmitted to the Director of Property and to the Board of Supervisors with the request that the Director of Property prepare and submit, and with the recommendation that the Board of Supervisors approve legislation authorizing the granting of said easements in and upon all of the Peninsula watershed lands to the United States of America for the purpose of preserving said lands in perpetuity for public water supply, open space and recreational uses.

The General Manager of Public Utilities is hereby authorized and directed to take the necessary steps to obtain concurrence in these grants by the State of California and the San Mateo County Board of Supervisors.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.5
	Date Adopted: September 22, 1970
History: Preference for long term leasing of land rather than selling property.	**Derivation:**
	Resolution: 70-0592 68-0163
	Minutes Page: 70-241
Subject: Long Term Lease of Land	

Statement

It shall be the policy of the Public Utilities Commission in the interest of preserving San Francisco's heritage to make land available on such long-term leases as may be necessary for adequate financing and it shall also be the policy to propose sale of property only in exceptional circumstances where such sale is warranted.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Bureau of Administration	**Policy Number:** WD 3.6
	Date Adopted: October 22, 1974
History: The PUC has the exclusive power to lease agricultural or other lands used or useful for Water Department purposes and at the same time available for leasing or rental for agricultural or other purposes. [Charter Section 7,402 (b)]	**Derivation:**
	Resolution: 74-0391
	Minutes Page:
Subject: Lease Procedures	

Statement

It shall be the policy of the Public Utilities Commission that whenever practical the competitive bid process shall be followed.

This Commission does hereby adopt the following procedures for the Water Department's bid process to lease property under its jurisdiction:

1. Negotiation of a lease will be limited to situations where there is only one interested party (e.g., right-of-way leases) or under special circumstances when it will be in the best interest of the department, as approved by the Commission. The Commission shall be properly informed whenever there is only one bidder on any lease, negotiated or otherwise.

2. Proposals for all leases, whether bid or negotiated, will be solicited from interested parties and the highest responsible and responsive bid will be submitted to the Commission for approval.

3. All leases will continue to be reviewed and approved by the City Attorney.

4. All Bidders shall furnish the appropriate department head information regarding personal background, personal and bank references, financial statements and evidence of experience which demonstrates ability to perform the terms of the lease. This information will be submitted to the Public Utilities Commission for the recommended lessee together with the departments' report of its independent investigation. A Dun and Bradstreet Report will be secured, if appropriate.

5. Successful bidder will furnish a Faithful Performance Bond or equivalent in a sum consistent with the terms of the lease.

   In lieu of the bond herein above provided, Lessee may deposit with the City a certified check, cashier's check, United States Government Bonds, or a bank passbook or certificate of deposit assigned to Lessor, in a sum equal to the amount of the performance bond.

   Deposits accompanying bids shall be by certified check or bank cashier's check.

6. Lessees, other than those on a flat fee rental, will provide an unqualified opinion of the financial statements within 60 days after close of each calendar or fiscal year.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.7
	Date Adopted: October 22, 1974
History:	**Derivation:**
	Resolution: 74-0392
	Minutes Page:
Subject: Quarterly Report on Delinquent Lease Payments	

Statement

The department head will furnish the General Manager and Public Utilities Commission a quarterly report listing all leases delinquent in rent payment during the previous three months with comments regarding the delinquency.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.8
	Date Adopted: April 8, 1975
History:	**Derivation:**
	Resolution:
	Minutes Page: 75-60
Subject: Lease — Renewal	

Statement

Staff is directed that all leases about to expire be brought to the Commission's attention prior to the expiration date. Submission of retroactive leases will not be tolerated.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.9
	Date Adopted: January 27, 1976
History:	**Derivation:**
	Resolution: 76-0047
	Minutes Page:
Subject: Peninsula Watershed Lands Recreational Development	

Statement

The Public Utilities Commission approves the concepts presented in the report of EDAW, Inc, dated August 1975, and reaffirms its policy of continued ownership of these lands for a protected public water supply with such open space, recreation and other appropriate public uses, as may be compatible with the primary purposes for which these lands were originally acquired and are now held in trust.

The enjoyment of these lands under said conditions shall be available to the public under the aforementioned policy.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.10
	Date Adopted: October 25, 1977
History: Public complaints against the visual impact of night lighting of the driving range were presented to the PUC. The Commission authorized a 120-day trial period for evaluation.	**Derivation:**
	Resolution: 77-0477
	Minutes Page:
Subject: Night Lighting on Watershed Land	

Statement

The Public Utilities Commission disapproves of the present visual impact of the Crystal Springs Golf Course driving range lighting and directs the Water Department to notify the Lessee to discontinue the operational use of the lights effective October 26, 1977.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.11
	Date Adopted: December 27, 1977
History: The City Attorney advised that insurance could be less than $1,000,000 Combined Single Limit, but in no instance should it be less than $300,000 Combined Single Limit.	**Derivation:**
	Resolution: 77-0544
	Minutes Page:
Subject: Insurance Requirement for Land Use Permits and Leases	

Statement

The Public Utilities Commission will consider and may authorize comprehensive general liability insurance of less than $1,000,000 combined single limit coverage in which documentation warrants such action on revenue-producing Land Use Permits and Leases to individuals and small businesses, providing that the use of lands being made under said Permits and Leases is of minimal exposure of City to liability claim.

This Commission may continue to exempt from insurance requirements street and utility crossing permits and gardening permits issued to adjoining property owners.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.12
	Date Adopted: February 14, 1978
History:	**Derivation:**
	Resolution: 78-0059 77-0494
	Minutes Page:
Subject: Beekeeping on the Watershed — Revocable Permits	

Statement

The Water Department is authorized to issue revocable permits to individuals and organizations for the keeping of beehives on the watershed properties in accordance with the recommendations contained in the consultant's report "Recommendations for Beekeeping Activities in Crystal Spring Valley Watershed District of San Francisco Water Department" as amended by the Department's memorandum "Beekeeping on Water Department Properties" to the Commission dated January 26, 1978.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.13
	Date Adopted: January 23, 1979
History:	**Derivation:**
	Resolution: 79-0039
	Minutes Page:
Subject: Beekeepers — Insurance Requirement	

Statement

The Public Utilities Commission rejects the San Francisco Beekeepers' request for a reduced requirement of $100,000 property damage automobile insurance for beekeepers on the San Francisco watershed. $300,000 Combined Single Limit shall be required.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.14
	Date Adopted: January 24, 1995
History: Supersedes Resolution Nos. 67-1090 authorizing the General Manager of Public Utilities to issue revocable permits; 74-0390 authorizing issuance of permits under $250.00 per month; 78-0458 authorizing gardening permits at $10.00 biennially. Rescinds 81-0341 authorizing issuance of permits under $600.00 per month.	**Derivation:**
	Resolution: 95-0010
	Minutes Page:
Subject: Secondary Use of Water Department Lands	

Statement

All leases, easements and permits to be entered into by the Commission for property under its jurisdiction shall be first approved by the Public Utilities Commission.

It is the policy of the Commission that the secondary use of Water Department lands for agricultural or other purposes shall at all times be subordinate to the needs and interests of the Water Department to protect its watershed lands, pipelines and other facilities from any harm, and that the Water Department shall seek to maximize the revenues to be derived from the secondary use of Water Department lands for agricultural or other purposes by negotiating on behalf of the Commission rents which reflect both the value and the intended use of the lands to be leased.

Resolution No. 81-0341 is hereby rescinded.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.15
	Date Adopted: February 14, 1995
History:	**Derivation:**
	Resolution: 95-0015
	Minutes Page:
Subject: Leases and Permits for Secondary Use of Water Department Lands and Rights-of-Way	

Statement

The Public Utilities Commission affirms the policies on issuance of leases and permits for the secondary uses of Water Department lands and rights-of-way.

The Commission requires that all leases, including those on flat fee rental, shall provide within 60 days after the close of the calendar or fiscal year annual financial statements attested to by a certified public accountant or public account as fairly representing the lessee's financial condition.

The Bureau of Finance shall be responsible for preparing and submitting to the General Manager of Public Utilities and to the Commission a quarterly report on delinquencies, a quarterly report on expired and expiring leases with comments on the status of lease renewal, and any other reports the General Manager or the Commission determines may be necessary or useful in their respective oversight and management of leases and permits for the use of Water Department lands and right-of-ways.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 3.16
	Date Adopted: February 28, 1995
History:	**Derivation:**
	Resolution: 95-0026
	Minutes Page:
Subject: Day Use and Special Use Permits	

Statement

The General Manager of Public Utilities or his designee is authorized to issue, amend, cancel, and execute day use permits for annual equestrian, wedding, hiking and group access, and special use permits for scientific study, Police and Fire Department training, educational and filming.

All other special use permits shall be subject to approval by the Public Utilities Commission prior to their issuance.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.4
	Date Adopted: July 2, 1968
History:	**Derivation:**
	Resolution: 68-0552
	Minutes Page:
Subject: Access to Watershed — Closing Sawyer Camp Road	

Statement

The Public Utilities Commission approves the current policy of the San Mateo County Board of Supervisors in closing Sawyer Camp County Road between 7 p.m. and 7 a.m. and reaffirms its cooperation with San Mateo County toward continuing this policy which allows the public to travel through this scenic area in the daylight period and yet permits closing the road at night to eliminate night parking and reduce vandalism and other misdemeanors.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.5
	Date Adopted: March 23, 1971
History: Section 602M of the Penal Code provides for the arrest of violators on private property if the owner gives the local police agency authority to enter the property to arrest trespassers.	**Derivation:**
	Resolution: 71-0102
	Minutes Page:
Subject: Control of Trespassers on the Watershed	

Statement

The Public Utilities Commission approves written authorization between the General Manager and Chief Engineer of the Water Department and the Chief of Police of South San Francisco and other such local law enforcement agencies as may request the same authority to arrest trespassers under Section 602M of the Penal Code.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.6
	Date Adopted: July 26, 1977
History:	**Derivation:**
	Resolution: 77-0325
	Minutes Page:

Subject: Indemnifying the Sheriffs of San Mateo, Santa Clara, Alameda, and Tuolumne Counties

Statement

In consideration for deputizing San Francisco Public Utilities Commission personnel, the Public Utilities Commission as the legally constituted representatives of the City and County of San Francisco, agrees to indemnify the Sheriffs of, and the counties of San Mateo, Santa Clara, Alameda and Tuolumne for all claims including legal judgments arising from the actions of such Special Deputy Sheriffs while performing duties for the City and County of San Francisco.

In consideration of the Sheriffs of the Counties of San Mateo, Santa Clara, Alameda and Tuolumne deputizing said employees of the City and County of San Francisco, the City and County of San Francisco shall provide counsel at City and County of San Francisco expense, to defend any and all lawsuits arising from the fact of deputization of the employees of the City and County of San Francisco by said Sheriffs of said counties.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.7
	Date Adopted: January 11, 1977
History: During periods of drought, the reserves of water supply are severely diminished and in future years will become increasingly critical as the daily system demand increases.	**Derivation:**
	Resolution: 77-0012
	Minutes Page:
Subject: Water Conservation and Use of Potable Quality Water	

Statement

It is the policy of the Public Utilities Commission to encourage continuing water conservation measures within the entire service area and restrict the use of high quality potable water to its highest and best use whenever possible.

The Water Department is directed to strongly encourage water conservation measures within its service area and to resist the use of large volumes of potable quality water when other recycled, salt water or undergroundwater can be reasonably utilized.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.13
	Date Adopted: September 12, 1978
History:	**Derivation:**
	Resolution: 78-0375
	Minutes Page:
Subject: Access to Watershed — Crystal Springs Vista Point	

Statement

The Public Utilities Commission requests the Board of Supervisors of San Mateo County to enact an ordinance designating Crystal Springs Vista Point to be a "NO PARKING OR STOPPING" area between the hours of 7 p.m. and 7 a.m.

Public Utilities Commission
City and County of San Francisco

STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.14
	Date Adopted: November 13, 1979
History: The County of San Mateo and the City of San Carlos requested approval to use a portion of the Water Department's Crystal Springs Watershed property for the construction of an access roadway.	**Derivation:**
	Resolution: 79-0445
	Minutes Page:
Subject: Disapproving Access Roadway on Watershed Land	

Statement

The Public Utilities Commission disapproves the request to construct an access roadway to connect between State Highway Route 280 and Crestview Drive in San Carlos on watershed land.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.19
	Date Adopted: December 8, 1992
History:	**Derivation:**
	Resolution: 92-0357
	Minutes Page:
Subject: Memorandum of Understanding with the Central California Coast Biosphere Reserve (CCCBR)	

Statement

The Public Utilities Commission approves execution of the Memorandum of Understanding with the Central California Coast Biosphere Reserve (CCCBR) by the Water Department General Manager.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: Water Department	**Policy Number:** WD 2.23
	Date Adopted: March 14, 1995
History:	**Derivation:**
	Resolution: 95-0044
	Minutes Page:
Subject: Right-of-Way Protection Program	

Statement

The Public Utilities Commission supports the San Francisco Water Department in the implementation of the attached Right-of-Way Protection Program.

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Right-of-Way Protection Program

A. Background

The Water Supply and Treatment Division maintains approximately 138 miles of pipeline rights-of-way (ROW) within San Mateo, Santa Clara, and Alameda counties. In most cases, the property traversed by the major pipelines is owned by the Water Department. In some cases, the Department has an easement but does not own the land.

From the Department's perspective, it is vital to protect transmission facilities from damage, and maintain ready access for maintenance and repair. This limits the overlying uses which can be allowed on the right-of-way. Any use recommended by the Department and approved by the Public Utilities Commission must demonstrate benefits and/or revenue opportunities without compromising the Departments primary functions of water supply and treatment.

Historically, most transmission lines ran through sparsely populated areas. However, as population has grown, a number of problems have developed:

- Inadequate vegetation management has resulted in growth of trees whose roots threaten the transmission lines.

- The ROW has become a dumping-ground for individuals desiring cheap disposal of unwanted goods and chemicals.

- Fences have been installed which impair SFWD access to pipelines for maintenance and repair.

- Encroachments have occurred where private buildings and/or parts of private facilities extend into the ROW.

- Unauthorized uses have developed (e.g., use of the ROW for unauthorized vehicular traffic) which represent a legal and financial liability to the City.

B. Program in Process

Because of the range of issues involved in maintenance and protection of the ROW, a Right-of-Way Committee meets monthly to coordinate and plan activities in this area. This Committee includes staff members from both Millbrae and Sunol Operations and Maintenance; Watershed Management; Land Engineering and Surveys; Corrosion Control; SFWD's Environmental and Regulatory Affairs Unit; and the Land Section. This Committee has developed and is implementing the projects described below which, taken collectively, make up the ROW program:

Right-of-Way Protection Program

Continued - page 2

1. Problem Identification and Resolution

Because of the length of the ROW, the task of identifying problems is considerable. Time is of the essence in addressing problems before their resolution becomes difficult and/or expensive (e.g. unauthorized construction and garbage dumping).

Therefore, a reporting form was developed to tap the diverse groups and individuals who regularly travel through the ROW during the performance of their duties (e.g., operations and maintenance staff). The "Right-of-Way Report" has been distributed to these groups/individuals to enable them to identify and report problems they observe in the ROW. The report provides for a description of the problem (including photographs when needed), recordation of its location in ways which are recognizable to different action groups, and the collection of adequate information to begin the process of correcting the problem. Samples of forms reporting various types of encroachments found in the ROW are attached.

Information on the ROW Report is entered into a computer database so that the information can be analyzed, and progress can be tracked. Encroachments, trees, and trespasses are sorted separately so that specific procedures for resolution can be set in motion. Information is collected on who is assigned the problem and what is being done. Completion dates are estimated to establish objectives, and status is reported on a monthly basis to the Right-of-Way Committee.

Several steps have been defined by WS & TD and the City Attorney's office to remove encroachments and unauthorized uses as follows:

a. The posting of signs along the ROW is often adequate to prevent encroachments and unauthorized uses.

b. Verbal notification of the trespassing property owner(s) has sometimes been adequate for the ROW to be cleared; when action is not taken, a letter is sent to the property owner.

c. Written notification has been posted and/or mailed to individuals where multiple properties are involved.

d. In the event that the property owner does not respond, the City Attorney's office is requested to assign a litigator to take additional action as needed. This approach has been applied to both physical encroachments (such as buildings) but also inappropriate uses (e.g., use of undeveloped ROW as a roadway).

Public Utilities Commission
City and County of San Francisco
STATEMENT OF POLICY

Department/Bureau: PUC General Management	**Policy Number:** GM 2.2
	Date Adopted: July 9, 1979
History:	**Derivation:**
	Resolution:
	Minutes Page: 79.246 Minutes June 24, 1980 — declining staff request to allow firearms
Subject: Firearms Prohibition	

Statement

Unauthorized possession of firearms on Utilities' property and in or about vehicles or equipment is prohibited.

Violation of this extremely important rule will be considered cause for immediate dismissal.

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO
STATEMENT OF POLICY

DEPARTMENT/BUREAU: Water Department

POLICY NO. WD 5.1

PG. 1 OF 1

SUBJECT: Junipero Serra Freeway

DATE: June 18, 1957

STATEMENT:

The Public Utilities Commission hereby expresses its opposition to the construction of the Junipero Serra Freeway along the proposed Route "B" or any other route damaging a major area of the San Francisco Water Department peninsula watershed lands. The Public Utilities Commission believes that a satisfactory route can be constructed near the easterly line of the peninsula watersheds or crest of the hills east of the reservoirs which route may occupy portions of the City's lands, provided that objectionable drainage from such portions of the freeway shall be removed from the reservoir property.

It is the expressed policy of this Commission to avoid conditions that would make necessary the costly process of filtration treatment of San Francisco's water supply; however, should filtration become necessary in the judgment of the San Francisco Water Department because of the location of a freeway, then, the State of California must assume the cost of constructing and operating suitable water treatment plants to preserve the purity and quality of the water supply.

DERIVATION:

RESOLUTION: 17,355

HISTORY: See also Resolutions 17,825; 65-0220; 66-0896; 67-0891; 68-0971; 69-0174.

MINUTES PAGE: 68-258

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO
STATEMENT OF POLICY

DEPARTMENT/BUREAU: Water Department	POLICY NO. WD 5.2 PG. 1 OF 1
SUBJECT: Preservation of Natural Environment	DATE: June 30, 1964

STATEMENT:

The Public Utilities Commission does hereby urge the State of California, Department of Public Works, Division of Highways to take all necessary steps in the construction of the Junipero Serra Freeway to retain all trees and other natural growth bordering the new highway. The San Francisco Water Department is directed to exert all the effort within their means to preserve as much as possible the natural beauties of the area along the eastern perimeter of the Crystal Springs Golf Course.

DERIVATION:

RESOLUTION: 24,085

MINUTES PAGE:

HISTORY:

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO
STATEMENT OF POLICY

DEPARTMENT/BUREAU: Water Department	POLICY NO. WD 5.3
	PG. 1 OF 1
SUBJECT: Eradication of Predatory Animals on Watershed.	DATE: Jan. 24, 1967

STATEMENT: The Public Utilities Commission hereby authorizes the General Manager of Public Utilities, on behalf of the Public Utilities Commission of the City and County of San Francisco, to execute that certain agreement between the San Francisco Water Department and the United States Bureau of Sport Fisheries and Wildlife covering the eradication of predatory animals on Crystal Springs watershed property in San Mateo County. All costs and expenses in connection therewith to be borne by the said Bureau and the County of San Mateo.

DERIVATION:

RESOLUTION: 67-0066

MINUTES PAGE:

HISTORY:

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO

STATEMENT OF POLICY

DEPARTMENT/BUREAU: Water Department	POLICY NO. WD 5.5
	PG. 1 OF 1
SUBJECT: Highway Route 186 and Interchange at Route 35 on Watershed Land.	DATE: May 20, 1968

STATEMENT: The Public Utilities Commission approves the location of Route 186 and of the interchange between Freeway Routes 186 and 35 on Water Department property as delineated on State Drawing No. 3008-220131, subject to proper measures to protect water quality, to cause minimum disruption of the watershed area as a natural reserve, and to preserve riding trails and the proposed equestrian area.

This Commission authorizes the General Manager of Public Utilities, or with his concurrence, the General Manager of the San Francisco Water Department, to discuss the design and criteria with the State Highway Commission to prevent contamination and pollution and preserve the adjacent areas.

DERIVATION:

RESOLUTION: 69-0318

MINUTES PAGE:

HISTORY:

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO
STATEMENT OF POLICY

DEPARTMENT/BUREAU: Bureau of Administration	POLICY NO. BA 1.2
	PG. 1 OF 2 pages
SUBJECT: Delegation of Authority -- Permits	DATE: Oct. 22, 1974

STATEMENT:

The Public Utilities Commission authorizes the present five general classes of permits to be expanded for clarification and another class of permits be added thereto together with their respective adjustment of required permit fees which are listed as follows:

1. Gardening and landscaping by adjoining property owners--$10.00 minimum permit fee, renewable biennially, required.
2. Usage by Public Agencies for:
   a) Street and utility crossings--no permit fee;
   b) Park, Recreation, Landscaping--reimbursement of 50 percent of taxes and assessments paid by the City and County of San Francisco;
   c) Other uses--permit fee based on the value of the land plus reimbursement of taxes and assessments paid by the City and County of San Francisco.

3. Uses by non-profit organizations--$1.00 per year permit fee, plus reimbursement of taxes on permittees' improvements used or located on City's right of way and any other tax arising out of permittees' operations upon said right of way.

4. Crossing by private utility companies--$75.00 minimum permit fee required.

5. Commercial usage--subject to consideration dependent upon usage.

DERIVATION:

RESOLUTION: 74-0390
67-0833 67-1090 78-0458
81-0341

MINUTES PAGE:

HISTORY:

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO
STATEMENT OF POLICY

DEPARTMENT/BUREAU: Bureau of Administration	**POLICY NO.** BA 1.2
	PG. 2 **OF** 2 pages
SUBJECT: Delegation of Authority -- Permits	**DATE:** Oct. 22, 1974

STATEMENT:

6. Agricultural farm and grazing usage--(Permits issued only because of minimal size, isolated location, or for an interim usage pending merger with larger parcel for lease)--negotiated permit fee.

This Commission authorizes the General Manager of Public Utilities to issue, amend, cancel, and execute all types of permit subject to a fee or consideration as indicated herein for each class, except those which would require considerations in excess of $600.00 per month exclusive of taxes and assessments.

The General Manager of Public Utilities is directed to require adequate insurance, adequate performance bond and/or adequate deposit of permit fee in advance to be maintained for the life of the permit as warranted.

This Commission authorizes the General Manager of Public Utilities to delegate the within authority to the Secretary and Assistant General Manager, Administrative, Public Utilities Commission, and to Department heads.

The General Manager of Public Utilities shall furnish a Quarterly Report to this Commission, which report shall list all pertinent information concerning permits issued, amended, delinquent in payment, or canceled during the previous three months.

Resolution No. 68-0592, adopted July 16, 1968, is hereby rescinded.

DERIVATION:

RESOLUTION: 74-0390
67-0833 67-1090
78-0458 81-0341

MINUTES PAGE:

HISTORY:

PUBLIC UTILITIES COMMISSION
CITY AND COUNTY OF SAN FRANCISCO
STATEMENT OF POLICY

DEPARTMENT/BUREAU: Bureau of Administration	POLICY NO. BA 5.15 PG. 1 OF 1 page
SUBJECT: Moratorium Granted to Grazing Lessees	DATE: Apr. 26, 1977

STATEMENT:

The Public Utilities Commission grants a moratorium to grazing lessees subject to certain conditions for at least one year, commencing November 1, 1977 through October 31, 1978. Any lessee of a grazing lease parcel who removes all of his livestock from his lease parcel before, but not later than June 1, 1977 shall be granted a 50% reduction in semi-annual rental payment due on May 1, 1977 for the period May 1, 1977 through October 31, 1977.

If the General Manager of the Water Department finds that said land will be adequately protected by reducing livestock numbers to be grazed with comparable reduction in rental, he shall recommend such reduction to the Commission.

DERIVATION: RESOLUTION: 77-0199 MINUTES PAGE:	HISTORY: Severe drought conditions seriously diminished the protective ground cover on watershed land and exposed the land to serious erosion problems.

RESOLUTION No. 82-0366

WHEREAS, Proposition 13, the Water Resources Conservation and Efficiency Act, will be on the November 2, 1982 statewide ballot; and

WHEREAS, Conservation and the efficient management of water resources are necessary to meet the competing needs of urban communities, industry, agriculture and recreation; and

WHEREAS, Proposition 13 will promote balanced development and preservation of water resources for the benefit of present and future generations of Californians; and

WHEREAS, Under the City and County of San Francisco's water rights and the existing water code, Proposition 13 will not preclude development of the Hetch Hetchy System to a capacity of 400 million gallons daily, now, therefore, be it

RESOLVED, That the Public Utilities Commission expresses its support of State Proposition 13, the Water Resources Conservation and Efficiency Act, on the November 2, 1982 ballot.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission

at its meeting of AUGUST 24 1982

Secretary, Public Utilities Commission

RESOLUTION No. 82-0405

WHEREAS, The Bay Area water agencies in an informal group known as the Bay Area Water Resources Council (BAWRC) have drafted a "Mutual Assistance Agreement" (the "Agreement") between eight of the water agencies; and

WHEREAS, This Agreement will be made by and between Alameda County Water District, Contra Costa Water District, East Bay Municipal Utility District, Santa Clara Valley Water District, Marin Municipal Water District, Sonoma County Water Agency, Zone 7 of Alameda County Flood Control and Water Conservation District, and the San Francisco Water Department; and

WHEREAS, The Agreement provides for assistance between the water agencies in case of an emergency; and

WHEREAS, The purpose of this Agreement is to provide the mechanism for each of the agency managers to seek and get help when and if needed in a rapid fashion; now, therefore be it

RESOLVED, That the General Manager of Public Utilities is empowered to sign the Agreement with any changes therein which do not change the material substance thereof, and the Secretary of the Commission is authorized and directed to attest the same.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission

at its meeting of SEPTEMBER 2 8 1982

Romaine A. Boldridge

Secretary, Public Utilities Commission

RESOLUTION NO. 84-0539

RESOLVED, That this Commission hereby adopts a policy that it will not in the future approve any east side road connections through the watershed from local roads to Interstate Highway 280 across the Scenic and Recreation Easement.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of NOVEMBER 13 1984

Lorraine A. Baldridge

Secretary, Public Utilities Commission

RESOLUTION NO. 84-0540

WHEREAS, A request has been submitted by the County of San Mateo and the City of San Carlos for the approval of a proposal to use a portion of the Water Department's Crystal Springs watershed property for the construction of an access roadway to connect between Interstate Highway 280 and Crestview Drive in San Carlos; and

WHEREAS, The County of San Mateo Board of Supervisors has adopted a resolution endorsing the proposed road connection and is requesting approval and action by the City and County of San Francisco; and

WHEREAS, The City of San Carlos has submitted an informal environmental analysis of the proposed connection between Crestview Drive and the I-280 Vista Point; and

WHEREAS, The City of San Carlos has adopted a negative declaration and submitted copies of it for the proposed project; and

WHEREAS, The City of San Carlos' proposal does not sufficiently address the City and County of San Francisco's concerns relative to the maintenance of security of its watershed lands or the passage across or underneath the proposed roadway by patrol and emergency vehicles; and

WHEREAS, These concerns can be satisfied in the terms of a land use agreement permitting this roadway across Water Department watershed lands; now, therefore, be it

RESOLVED, That this Commission approves the proposed road connection subject to the conditions that the Commission's concerns regarding the maintenance of the security of its watershed lands and emergency vehicle passage underneath the roadway will be satisfactorily settled, and the appropriate contract will be returned to the Commission for final approval.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission

at its meeting of NOVEMBER 13 1984

Romaine A. Boldridge

Secretary, Public Utilities Commission

RESOLUTION NO. 85-0333

WHEREAS, the City Attorney has recommended that the case of Betchart, et al. vs. City and County of San Francisco, San Mateo Superior Court No. 256-890 be settled and compromised by the City and County of San Francisco, as grantor, executing an easement deed (a copy of which has been submitted to this Commission) granting a right-of-way to plaintiffs over watershed property; and

WHEREAS, this Commission finds that of the settlement proposal recommended by the City Attorney is in the best interests of the City and County of San Francisco and its Water Department;

NOW, THEREFORE, BE IT RESOLVED that this Commission concurs with and approves (subject to further approval by the Board of Supervisors and the Mayor) the settlement recommendation of the City Attorney that the aforesaid litigation be compromised settled by execution of an easement deed granting plaintiffs a right-of-way over a watershed property; and

RESOLVED FURTHER, that the Board of Supervisors, and the Mayor, are hereby requested to enact appropriate legislation authorizing City officials to execute the proposed easement deed.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of AUGUST 27 1985.

Romaine A. Boldridge

Secretary, Public Utilities Commission

RESOLUTION No. 86-0170

WHEREAS, Alameda County has approved a surface mining permit for the Apperson Ridge Quarry; and

WHEREAS, This proposed quarry is located on private property within the watershed of San Antonio Reservoir; and

WHEREAS, Access to the quarry will be over property of the City and County of San Francisco through a previously approved road easement; and

WHEREAS, This proposed quarry and access road have a potential for significant adverse effects on water quality and the environment; and

WHEREAS, This proposed quarry and access road have received extensive environmental review; and

WHEREAS, Water Department staff has reviewed and approved construction and operating plans related to road construction and quarry operation; and

WHEREAS, There will be adequate mitigating measures to prevent degradation of water quality or the watershed of San Antonio Reservoir; now, therefore, be it

RESOLVED, That this Commission approves the amended road easement for the Apperson Ridge Quarry, the Memorandum of Understanding with the Alameda County Department of Public Works and the Memorandum of Agreement with the quarry operator; and

BE IT FURTHER RESOLVED, That this Commission recommends approval by the Board of Supervisors of the amended road easement.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of MAY 13 1986

Romaine A. Boldridge

Secretary, Public Utilities Commission

RESOLUTION NO. 87-0029

RESOLVED, That this Commission hereby approves the terms and conditions and authorizes the execution of that certain 106± acre lease to Recreation Express, Inc., Lessee, for the purpose of developing, operating and maintaining a recreational and picnic park as set forth in lease (copy of which lease is on file with the San Francisco Water Department) of certain real property under the jurisdiction of San Francisco Water Department shown on Water Department Drawing No. B-4133-3 for a term of ten (10) years with option for two additional five (5) year periods, commencing with the execution of said lease, at an initial minimum annual rental of $2,650 for the 1st year, $24,000 for the 2nd year, $36,000 for the 3rd year, and for each suceeding year thereafter, the minimum rental to be adjusted in direct proportion to any percentage increase in the C.P.I. over the preceding year, but not to exceed 10%, or the percentage rental of five (5) percent of the gross annual receipt during each of first five (5) years, to be adjusted to 6%, 8% and 10% on the sixth, eleventh and sixteenth year respectively of the lease term, whichever is greater; and be it

FURTHER RESOLVED, That the City's Board of Supervisors be requested to confirm the approval of this lease by ordinance.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of JANUARY 27 1987

Romaine A. Boldridge

Secretary, Public Utilities Commission

CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 87-0172

WHEREAS, The watershed areas which supply the City of San Francisco and the suburban areas are projected to have only 45% of normal run-off this year; and

WHEREAS, A water conservation program designed to reduce consumption overall by 10% this year is necessary to protect against the possibility of a second dry year; and

WHEREAS, A comprehensive, system-wide public information campaign is a critical part of the conservation program; and

WHEREAS, The 30 suburban water supply agencies who purchase water from San Francisco have initiated a public information campaign through the Bay Area Water Users Association; and

WHEREAS, Early expansion of this campaign to include San Francisco will increase the effectiveness of the public information activities and result in greater water savings; now, therefore, be it

RESOLVED, That this Commission authorizes the General Manager of the Water Department to enter into a memorandum-of-understanding with the Bay Area Water Users Association to allow San Francisco to reimburse the Association for appropriate expenses incurred in system-wide public information activities designed to reduce water consumption by 10% with maximum costs not to exceed $35,000.00 and funds available in appropriation 47-00-00-32-001-387019, Object 140 - Fixed Charges.

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of MAY 12 1987

RESOLUTION No. 88-0181

WHEREAS, The success of the water rationing program approved by the Public Utilities Commission on April 28, 1988 requires an effective systemwide public information program to obtain public understanding and cooperation; and

WHEREAS, The Public Utilities Commission previously approved the Water Department entering into an agreement with the Bay Area Water Users Association representing San Francisco's 30 suburban resale customers to respond to the dry conditions in 1987 by developing a system-wide conservation program; and

WHEREAS, This partnership was successful in promoting water conservation on a timely and cost-effective basis; and

WHEREAS, A cooperative program with the Bay Area Water Users Association provides the most effective and least costly means of developing and implementing a system-wide public information program for the current water rationing program; and

WHEREAS, A continuation of the working arrangement instituted in 1987 between the Water Department and the Bay Area Water Users Association on water conservation programs is necessary for the success of the water rationing program; now, therefore, be it

RESOLVED, That this Commission authorizes the General Manager of the Water Department to enter into a memorandum-of-understanding with the Bay Area Water Users Association to allow San Francisco to reimburse the Association for appropriate expenses incurred in development and implementation of system-wide public information programs with the cost not to exceed $90,000 and funds available in appropriation 47-00-00-32-001-387019, Object 140, Fixed Charges.

0252D-6

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of MAY 24 1988

Romaine A. Boldridge

Secretary, Public Utilities Commission

RESOLUTION No. 87-0361

WHEREAS, There is an increasing demand on Hetch Hetchy and local water supplies; and

WHEREAS, Increased use of San Francisco's groundwater resources for non-potable uses such as irrigation and firefighting can help meet this demand and make a significant contribution to conservation of high quality drinking water supplies; and

WHEREAS, An overall study of these groundwater resources is necessary to determine the potential supply availability; and

WHEREAS, The United States Geological Survey, the recognized federal authority in this field, is willing to perform the necessary studies; and

WHEREAS, The estimated cost of $100,000 for the first year studies will be shared on a matching basis between San Francisco and the United States Geological Survey; now, therefore, be it

RESOLVED, That this Commission hereby authorizes the General Manager of the Public Utilities Commission to enter into an agreement with the United States Geological Survey to assess the supply potential of San Francisco's groundwater resources; the costs to be shared with the City of San Francisco on a matching basis with San Francisco's share not to exceed $50,000 during the first year, the term of the agreement to be September 1, 1987 to September 30, 1988.

0371D

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of SEPTEMBER 8 1987

Romaine A. Boldridge
Secretary, Public Utilities Commission

PUBLIC UTILITIES COMMISSION

CITY AND COUNTY OF SAN FRANCISCO

RESOLUTION No. 89-0033

WHEREAS, The Water Department of the City and County of San Francisco owns and operates the Upper Alameda Diversion Dam and Tunnel, Calaveras Reservoir and outlet works, the Calaveras Aqueduct, and the Sunol Filtration Plant for the purpose of providing a portion of the water supply to the City and County of San Francisco; and

WHEREAS, On September 9, 1988 the Pacific Water & Power, Inc., a California corporation, filed application for a Preliminary Permit with the Federal Energy Regulatory Commission (FERC) to construct certain power generation facilities at the City's Calaveras Diversion Dam and Sunol Filtration Plant; and

WHEREAS, If FERC were to grant the application and subsequently award a license to Pacific Water & Power, Inc., the City would be precluded from developing the power potential of its own facilities for the benefit of the City and its residents; and

WHEREAS, It is preferable if power can be produced economically, consistent with water operations, that the City should gain the benefits; and

WHEREAS, A FERC Preliminary Permit allows up to 36 months to study a project's feasibility; and

WHEREAS, Other facilities of the San Francisco Water Department may also have potential for the development of power generation; and

WHEREAS, The studies and related studies of other potential projects should require less than $50,000 from future capital expenditures over a 36-month period; and

WHEREAS, The City and County of San Francisco as a public agency is granted preference under the Federal Power Act for the licensing of power generation facility; now, therefore, be it

RESOLVED, That the General Manager of the Water Department is authorized to file with FERC an application for a Preliminary Permit to study power production at Calaveras in competition with the application of Pacific Water & Power, Inc. and is further authorized to undertake preliminary studies of potential power developments at other Water Department facilities.

0018f-20

I hereby certify that the foregoing resolution was adopted by the Public Utilities Commission at its meeting of JANUARY 24 1989

Romaine A. Boldridge

Secretary, Public Utilities Commission

Call to Order: 5:15 P.M.

Present: President Rodel E. Rodis, Vice President Sherri Chiesa,
Commissioner H. Welton Flynn, Commissioner Gordon Chin

Excused: Commissioner Arthur V. Toupin

A tape of the meeting is on file in the office of the Secretary of the Public Utilities Commission.

RESOLUTION
NO.

On motion of Flynn, seconded by Chiesa, the following resolution was adopted in Executive Session:

90-0167 MR Authorizing the City Attorney to file suit under the California Environmental Quality Act against Modesto Irrigation District, the City of Modesto, and the Del Este Water Company.

VOTE: Ayes - Rodis, Chiesa, Flynn, Chin

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PUBLIC HEARING - On proposed golf course to be located on San Francisco Water Department land on the southern portion of the Crystal Springs Watershed, within the Scenic and Recreation Easement.

Video Presentation

A video tape was shown which identified the proposed site for the golf course and provided background information.

Address by Public Officials

Honorable Tom Nolan, San Mateo County Board of Supervisors, described the county's efforts over the last 20 years to obtain a public golf course on Crystal Springs Watershed. He presented letters of support for the proposed site from various environmental organizations and urged the Commission to proceed with the project. Other speakers representing San Mateo County supporting the golf course were: the Honorable Mary Griffin, Member, Board of Supervisors; Mr. John Maltbie, County Manager, Mr. Paul Koenig, Director of Environmental Management; Mr. Dave Christy, Director of Park and Recreation.

Honorable Joan Stiff, Mayor of the Town of Woodside, urged the Commission to accept the suggestion from Mr. Brian O'Neill, Superintendent of the Golden Gate National Recreation Area, to develop an updated Recreation Use Plan that recognizes the value of watershed lands as natural open space. She opposed the PUC staff recommendation to seek an environmental consultant. Also, speaking on behalf of the City of Woodside in opposition to a golf course were: Ms. Nancy Alexander, Planning Director; Honorable Barbara Seitle, Member, Woodside Town Council; Honorable Jean Dickey, Member, Woodside Town Council; Honorable Richard Rodds, Member, Woodside Town Council. It was stated that in 1989 the proposed site was included in the Northern California Coast Biosphere Reserve by UNESCO.

Public Comments

Mr. Robert Trent Jones Jr., Consultant to San Mateo County and golf course architect, stated that a professional golf course designer could design a course on this site within standard restrictions for pesticides and other chemicals.

President Rodis called speakers -- alternating between those who supported the golf course proposal and those who opposed it.

Speakers in Support

- Mr. Floyd Boyer, Vice Chairman, Edgewood Park Citizens Committee
- Mr. Walter Small, Redwood City
- Mr. Howard Boone, Woodside
- Mr. Ray Witt, Palo Alto Men's Club
- Mr. Gary Kah, Redwood City
- Mr. Pete Peabody, Menlo Park
- Mr. Bill Royce, Redwood City
- Mr. James Brown, San Carlos
- Ms. Barbara Koontz, San Carlos
- Mr. Dean McHan, San Carlos
- Ms. Jan La Fetra, Menlo Park
- Mr. Chris Yoshii, Economics Research & Associates
- Mr. Paul Fregulia, Woodside
- Mr. Paul San Fleipo, Redwood City
- Ms. Jan Wagner, San Francisco
- Mr. Alex Esclamado, So. San Francisco
- Mr. David Collins, San Mateo

Speakers Opposed

- Dr. Howard Wilshire, Mountainview
- Mr. Revett Wallace, Woodside
- Ms. Dee Dobson, Woodside
- Ms. Sue Butler, San Mateo
- Mr. Jacob Sigg, San Francisco
- Mr. Jim Gravanis, San Francisco
- Ms. Marion Gallagher, Atherton
- Ms. Sally MacBride, Woodside
- Ms. Hunter, Woodside
- Mr. Robert MacBride, Woodside
- Mr. Leon Campbell, Woodside
- Mr. Dixon Reilley, San Mateo
- Ms. Olive Mayer, San Mateo County Chapter, Sierra Club
- Mr. Hans Kleemann, San Bruno
- Mr. John Mock, Palo Alto
- Ms. Brenda Butner, President, San Mateo Chapter of Californian Native Plant Society
- Mr. Sidney Liebes, Atherton
- Mr. W.G. Pinney, San Mateo
- Mr. Chris Allen, Central California Coast Biosphere Reserve
- Mr. Jim Degrran, Woodside
- Ms. Anseth Millington, Woodside
- Mr. Robert Carlson, San Carlos
- Mr. Bill Freedman, Hillsborough

Some of the points raised in support of the project were: there is a need for a public (i.e. affordable) golf course in San Mateo County; it would produce revenue for the county; a good water irrigation system can recycle the water used on the golf course; wildlife thrives on existing golf courses; Crystal Springs Golf Course has not contaminated the reservoir; golfing is a good and safe activity for senior citizens and women; public land should be used for the enjoyment of the public; the local demand for golf exceeds the available facilities; and turf grass will produce oxygen which is beneficial to the environment.

Some of the points mentioned by speakers opposing a golf course were: concern for the amount of water a golf course would require, especially during a drought, and who pays for that water; the affect on the area as a wildlife refuge and a designated international biosphere reserve; inclusion of the wildflower triangle area as part of the proposed site; public land belongs to everyone and should be conserved and preserved for future generations as open space; a restaurant would generate sewage; a golf course would provide recreation for affulent citizens and not for the general population; the recreation plan should be updated before preparation of an environmental impact report (EIR); there would be a visual impact from Interstate Highway 280; the Crystal Springs Golf Course could be municipalized when the lease expires; the Native Plant Society's survey of the southern watershed site did not include the triangle area; and the public should be allowed to vote on this matter.

President Rodis thanked the public for their comments and participation in this public hearing.

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THEREUPON THE MEETING WAS ADJOURNED: 8:37 P.M.

Romaine A. Boldridge
ROMAINE A. BOLDRIDGE
Secretary